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BULLETIN

OF

MISCELLANEOUS INFORMATION.

1893.

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1894

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pæne concoloribus, petiolis gracilibus folio æquilongis, calycibus subglabris dentibus spinosis supremo multo majore ovato acuminato cæteris minutis inter se æqualibus, bracteæ reflexæ lineares, corollâ calyce 3-plo. longiore.

Habitat.—In sylvis montis Malowe in ditione Griqualand Orientalis, alt. circa 4,500 ped. Martio legit *W. Tyson*, ann. 1886. *Herb. Austro-Africanum*, No. 1300; *W. Tyson*, 2766.

Folia 2½–3 poll. longa, 1¼–2 poll. lata; petiolus 1½–2 poll. longus.

Nearest to *L. intermedia*, Lindl., from which it is well distinguished by the much broader, almost triangularly ovate saturate green leaves, which are thinner, laxer, and more glabrescent than those of any other species. The armature of the calyx is less firmly spinose than that of *L. ovata*, Spr., more so than the almost unarmed *L. intermedia*, Lindl. Besides the specimens distributed from Tyson's collection, there is a characteristic example in the Cape Government Herbarium, marked "Port Natal," probably from Queinzius.

38. **Achyrospermum urens**, *Baker* [Labiatæ]; fruticosum, ramis foliisque pilis urentibus copiosis præditis, foliis petiolatis ovatis crenatis acutis, verticillastris dense capitatis, bracteis ovatis acutis, pedicillis brevissimis, calycis dentibus ovatis tubo brevi infundibulari brevioribus, corollæ rubræ tubo e basi ad apicem sensim ampliato lobis parvis rotundis triplo longiori, genitalibus breviter exsertis.

Habitat.—North Madagascar, *Rev. R. Baron*, 6296, 6314.

Folia 3–6 poll. longa. *Calyx* 2 lin. longus. *Corolla* 7–8 lin. longa.

This is the Labiate with stinging hairs mentioned in the Kew Bulletin, 1892, p. 150. It is a small shrub, with leaves resembling those of *Urtica dioica* and flowers like those of *Salvia coccinea.*

39. **Selaginella (Heterostachys) Kunstleri**, *Baker* [Selaginellaceæ]; caulibus continuis late repentibus intricatis, fibris radicalibus ad caulis apicem productis, ramis distantibus erectopatentibus, ramulis paucis brevissimis, foliis distichis plani inferioris firmulis laxe dispositis ovatis amplexicaulibus antice productis magis rotundatis, plani superioris minoribus inæquilateraliter ovatis aristatis, spicis brevibus densissimis, bracteis valde difformibus majoribus linearibus dense ciliatis minoribus ovatis cuspidatis dorso acute carinatis.

Habitat.—Larut, Perak, alt. 100–300 ft., *Dr. King's collector*, 1866.

Folia majora ¾ lin. longa. *Spicæ* 2–3 lin. longæ, interdum furcatæ.

Resembles *S. Kraussiana* in general habit. It belongs to the group *Bisulcatæ*, of which only four species were known previously. It was the only new species of *Selaginella* contained in the large set of Vascular Cryptogamia of the Malay peninsular which has been gathered lately by Dr. King's collectors.

40. **Bambusa Wrayi**, *Stapf.* [Gramineæ]; alte scandens, culmo superne tenuissimo nutante sæpe usque ad solum flexo inermi, internodiis flavidis glabris teretibus nitidis, foliis lineari-lanceolatis longe et angustissime accuminatis basi rotundatis lævibus glabris, nervis secundariis utrinque 7–8, vaginis striatis pallidis glabris, ligula truncata brevi pilis 3–6 lin. longis deciduis ciliata, panicula nuda vel apicem versus foliosa a basi ramosissima ramis aut abbreviatis arcte congestis verticillatis aut semiverticillatis vel elongatis, spiculis laxius dissitis vel sæpius fasciculatim congestis, fertilibus paucis, glumis gradatim increscentibus infimis 2 vacuis ovatis sequentibus 2–3 plerumque gemmiparis lanceolatis acuminatis tenuiter coriaceis opacis marginibus ciliatis, florifera rachillam tenuem elongatam

gemmulam rudimentariam gerentem æquante vel subæquante, palea submembranacea gluma sua paulo breviore superne bicarinata in carinis asperula vel ciliata in sulco dorsali rachillam productam et rudimentum recipiente, lodiculis obovatis ciliatis subæqualibus, antheris 6 glabris basi sagittatis muticis, ovario oblongo sensim in stylum brevem attenuato, stigmatibus tribus tenuis plumosis, caryopside (immatura) e basi oblonga in rostrum brevem cylindricum attenuata.

Habitat.—Mt. Gunong Inas, at the source of the Selama River and at the source of the Plus River, 4,500–5,500 ft., *L. Wray* (Perak Mus. Herb., Fl. Malay Pen., No. 4,166).

Culmus 40–60 ped. altus, basi circa 1 poll. crassus, internodio tertio vel quarto interdum ad 7 ped. longo. *Folia* 8–10 poll. longa, 10–13 lin. lata. *Panicula* a 5–8 poll. ad 3 ped. longa. *Spiculæ* 6-9 lin. longæ. *Glumæ* infimæ ad 4½ lin. longæ. *Ovarium* vix 1 lin. longum, stigmatibus 1½–2 lin. longis.

This species, like *B. Griffithiana*, Munro, is closely allied to *Nastus*, so far as the composition of the spicula is concerned. The fertile spicula begins with an empty bicarinate glume which is pressed against the relative primary axis. Then follow 1–2 empty and 2–3 mostly bud-bearing glumes which increase in size and are, except the lowermost, but indistinctly unicarinate; above these is the single fertile glume and a rudimentary bud borne by a long pedicel, a prolonged internode of the axis of the spicula. Sometimes the buds (gemmæ) grow into sterile spiculæ almost the length of the primary one. They also begin with a bicarinate glume which is followed by closely set ecarinate glumes increasing in size up to a certain point, thence decreasing. These, like all sterile spiculæ, bear in the axils of most of their glumes more or less reduced branchlets in the shape of small buds, and there is no prolonged internode in their rachilla. As all ramifications within the inflorescence begin with a bicarinate bract ("adossirtes Vorblatt," Eichler), and those bracts are all of the same shape and, as also the bracts of the other series to which the gemmiparous and the fertile glumes belong, are like each other, and only differ in size, it is often nearly impossible to distinguish the single spiculæ.

So far the composition of the spiculæ is almost the same as in *B. Griffithii*, and it approaches very much that of *Nastus*. The only deviation from the structure in the latter genus is the presence of gemmæ. The anthers, styles, and ovary are as in *B. Griffithii*. But whilst the lodiculæ in *B. Griffithii* are, according to Munro, unequal, as in *Nastus*, I find them equal, or almost so, in *B. Wrayi*. On the other hand both *B. Griffithii* and *B. Wrayi* differ from *Nastus* in the shape of the ovary, which is oblong, gradually tapering into the short style, which persists in the fruit as a cylindric beak, instead of being widened above. The glumes are coriaceous, but not so prominently nerved as in *Nastus*, and more like those of most *Bambusæ*. In habit and leaves *B. Wrayi* differs very much from *B. Griffithii*, approaching more nearly *B. arundinacea*, at least so far as herbarium specimens are concerned. If we imagine the "gemmæ" of the fertile spiculæ as being all entirely suppressed, we should have exactly the same structure as we have in *Nastus*. The step to this is hardly greater than from the many-flowered spiculæ of the majority of *Bambusæ* to the one-flowered spiculæ of *B. Griffithii*, and if we retain this in *Bambusa*, we ought, I think, to reduce *Nastus* also to *Bambusa*, where it might stand as a section or as a subgenus, distinguished by the more distinct reduction of the structure of the spiculæ, but linked very closely to the true *Bambusæ* by *B. Wrayi* and *B. Griffithii.* From a geographical point of view it is very interesting to note that the centre of *Nastus* lies quite at the periphery of the common area of the other *Bambusæ*, in Madagascar and in the island of Bourbon, and that it just reaches Western Sumatra (Angkola, Junghuhn, according to Munro). Here in the most western part of the Malayan flora it is joined by its nearest ally, *B. Wrayi*, whilst *B. Griffithii* was found in the extreme north of Burma and in Manipur by Mr. C. B. Clarke.

Mr. *L. Wray*, jun., states that this Bamboo was only found in the two localities mentioned above. According to him it dies off after having fruited. The Lemangs call it *Buloh Bersumpitan*, and they "use the large canes for the outer case of their arrow blowpipes; the "small ones for the inner tube. They strengthen them over a fire when "green and hang them up in the smoke of their cooking places to dry."

In numerous sterile spiculæ the 4th or 5th glume was deformed by insect action. The basal portion was much enlarged and adnate to the likewise enlarged next internode of the rachilla. This portion, a kind of oblong gall, contained the larva of the insect in the cavity.

In regard to the plant described above (*Bambusa Wrayi*) the following interesting particulars respecting it are contained in a letter received at Kew from Mr. Wray, dated Perak, June 14th, 1892:—

Mr. L. WRAY, junr., to ROYAL GARDENS, Kew.

Perak Government Museum, Larut, Perak,
Straits Settlements, June 14th, 1892.

DEAR SIR,

I RECENTLY went up a mountain called Gunong Inas, in the north of this State, and procured live plants of the bamboo of which the Semangs make their blowpipes, known by the Malay name of *Buloh versumpitan*.

If these plants grow I will send them to you before the cold weather sets in. I have sent them up the hills here, where they will be at nearly the same elevation as their natural habitat.

I was also fortunate enough to find a clump of these bamboos in flower, and I send you the specimens. As I expect this is a new species, and that you will describe it, I have sent you all the specimens, as it is better to have the whole material available to describe from. I would ask you, after having kept what you require for your herbarium, to kindly send the duplicates to Dr. King, of Calcutta.

The plant grows at from 4,500 feet to nearly 6,000 feet elevation, generally on the ridges of the hills. The canes are about 1 inch in diameter near the ground, and taper away to $\frac{1}{16}$ inch. These long thin ends drop down till they touch the ground. The canes are from 40 to 60 feet long. They are furnished with whorls of leaves at all the upper joints, and, as can be imagined, the bamboo is about the most elegant of its kind. From what I saw I arrived at the conclusion that this plant having arrived at maturity, fruits and then dies. I cannot form any idea at what age this happens, but I saw a cane which had been partly cut through by a knife, and it was still in vigorous growth; and as this hill has not been visited since 1886 this particular cane must be at least six years old, and as there would be many successions of canes before a plant reaches maturity the age of these bamboos must be very considerable. When they fruit, the barren canes die and are replaced by canes on which flowers appear at all the upper joints. I saw two dead clumps which had fruited.

The joints are often over 7 feet in length. The longest joint of a cane is generally the third or fourth from the ground. The Semangs use the large size canes for the outer case of their blow pipes, and the small ones for the inner tube. They straighten them over a fire when green, and hang them up in the smoke of their cooking places to dry.

They appear to grow in two places only in Perak. That is on the mountains at the source of the Plus River, and on the mountains at the source of the Selama River, from the latter of which localities the specimens now sent were obtained.

The parcel goes by this mail, and I hope will reach you in safety.

I am, &c.
(Signed) L. WRAY.

W. T. Thiselton-Dyer, Esq., C.M.G., &c.,
Royal Gardens, Kew.

CCXCIII.—CLOVE INDUSTRY OF ZANZIBAR.

An account of the agricultural resources of the island of Zanzibar was given in the *Kew Bulletin* for April 1892, p. 87, and reference was made to a report on the same subject prepared by Sir Gerald Portal and issued by the Foreign Office (Annual Series, 1892, No. 982). Another report has now been issued by the Foreign Office on the "Spice and other cultivation of Zanzibar and Pemba Islands," prepared for Sir Gerald Porter by Mr. FitzGerald, a specialist on tropical agriculture in the employment of the Imperial British East Africa Company.* From this latter report the following extract is taken respecting the clove industry of Zanzibar and Pemba.

The clove is undoubtedly the principal and most important cultivation of Zanzibar, and grown, wherever the soil is suitable, from the large and extensive plantations belonging to the Sultan and his family to the few trees owned by the more humble cultivator.

The soil of Zanzibar, with the exception, however, of that of Pemba, which excels it in this respect, is certainly eminently adapted for this cultivation. The soil most suitable for clove cultivation is "a dark " loam, having underneath a layer of dusky yellow earth, intermixed with " gravel;" also "a yellowish or reddish stiff clay;" and these typical soils are all found on the island. The clove tree requires clay, and I observed there was always a marked difference in appearance between trees growing on a clay soil—red for preference—and those found on a lighter ground; and the finest trees were always either growing on red clay, or else a stiff dark red to darker chocolate soil.

The clove tree (*Caryophyllus aromaticus*) is a native of the Moluccas, and was introduced into Mauritius in 1770 by the French, and at the end of the century an Arab, by name Harameli-bin-Saleh, accompanied a French officer from Zanzibar to Bourbon and obtained permission to take back a small quantity of seeds and plants with him. This was the commencement of clove cultivation in Zanzibar, Harameli making the first plantation at Mitoni, on the road to Chueni; and the cultivation rapidly spread. The different methods by which this cultivation is now carried on are evidently borrowed from the French, and the Swahili word for clove, "garafu," is probably a corruption of the French word "giroflier."

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* Foreign Office, 1892, Miscellaneous Series, No. 266, Zanzibar. Price Fourpence.

NURSERIES.

The seeds are first soaked in water for three days, and when germination has set in they are planted out 6 inches apart, with the bud end above ground, into shaded beds—the usual practice being to put down two seeds together in case of failure. If a large number of plants are to be grown the seeds are only put down 3 inches to 4 inches apart.

Beds are about 6 feet wide, and of any length. They are shaded by a flat framework of sticks, over which is placed a layer of either dry grass or cocoanut leaves; the height of this framework is about 3 feet to 3½ feet.

There is no regular rule for watering the seedlings, the important point being to keep the beds constanty damp. The slaves in charge go over the nursery beds both morning and evening, watering any of which the surface has become dry, the practice being to sprinkle water with the hand from the water jar. The plants are kept, on an average, from nine months to one year in shaded beds. When the plants are about 6 inches high they are by degrees hardened by the thatch of the framework being gradually removed, and they are then left in the open beds freely exposed to sunshine for the space of one month or two months before planting out.

PLANTING.

The usual planting distances appear to vary, and no regular or fixed rules appear to exist.

The most customary, as given to me by Ragu, the head overseer of the Sultan's plantations, is 24 feet apart, but also in small plantations it is 18 feet, rising in larger ones to 36 feet.

Lining is done by rope, but no pegs are used, the distances being marked by a cut with the hoe. This work is very carefully carried out, and the appearance of the majority of plantations is very striking in this respect, whichever way one looks the trees presenting an unbroken and uniform straight line.

The process of holing is as follows:—A large circular sloping hole, 4 feet in diameter, is cut, in the centre of which is cut a smaller hole, 1 foot by 1 foot or 9 inches wide; this smaller hole receives the plant; the wide upper portion remains unfilled, and serves as a catch drain or reservoir. This is in process of time gradually filled up by weeds, fallen leaves, &c.

Special care is also taken in planting out. The earth round the plant is loosened by a peculiar triangular-shaped spade used especially on clove plantations, and called "moaa," and in use in Zanzibar, as well as the ordinary native "jembe," or hoe, already referred to.

The plant is then carefully lifted out by the hand with as much earth adhering to the roots as possible, and placed upon two strips of banana fibre previously placed crosswise upon the ground. (Each strip of fibre is about 3 inches to 4 inches wide, by 1½ feet to 2 feet in length.) The four ends are then taken up and wrapped round the plant and firmly tied together. The plant is then carried to its destination, the strips of fibre effectually keeping the earth in position. Before planting, the pieces of fibre passing beneath are cut at each corner, and the plant finally placed in the hole prepared for it and the earth heaped round; the four ends of the fibre left at the sides are then removed one by one, the bottom portion being cut through enabling this to be done with ease.

If the weather is hot, or in the event of drought, the young plant is watered in the evening daily, and watering is continued as required until the plant attains the height of 18 inches, or, roughly speaking, during the space of one year. The young plants are not shaded in any way after planting.

AGE OF TREES.

There are some trees now growing on the island which are said to be nearly 90 years of age, but the average length of life of the clove tree in Zanzibar appears to be from 60 years to 70 years, and I have this on the authority of Mahomed-bin-Saif Drumiki, an elderly Arab of much experience, and who has been for over 20 years in charge of the Sultan's plantation at Indo. Such terrible devastation resulted from the great hurricane of 1872, when nearly all the clove plantations on the island were destroyed, that the average age of the trees now growing may be put down as below 20 years, and the age of the trees in the Sultan's plantation, the largest in the island, is from 16 years to 17 years.

The appearance of the clove plantations is, as a rule, most healthy and luxuriant, the height of the more matured trees averaging fully 40 feet, and the branches of the two rows often completely shading the ground. Clove trees generally have forked stems, and often as many as three and four. A single-boled tree is the exception.

DISEASES AND ENEMIES.

So far as I have been able to ascertain, and I have made careful inquiries on this subject, the clove tree is not subject to any fungoid disease, and the per-centage of dead, dying, and unhealthy trees noticed by me was very small, and the cause generally was either a damp situation, or else want of cultivation.

The clove tree, however, suffers from the attacks of two enemies:—one, a caterpillar, which attacks the foliage in the dry weather and often denudes the tree of its leaves, but the tree recovers at once as soon as the rains set in. The other is the white ant, which occasionally attacks the roots. No remedial measures appear to be taken.

TIME OF BEARING.

Clove trees begin to yield, in good situations, 5 years from planting; in inferior soil, 6 years to 6½ years from planting.

Mohamed-bin-Saif, the overseer of Indo, informed me that he remembered trees destroyed by the hurricane of 1872, which singly yielded 5 frasilas each (175 lbs.).* Also the head overseer of the Sultan's plantations has furnished me with the following averages:—three trees will yield 2 frasilas; 4,000 trees, 50 frasilas.

TIME OF GATHERING.

The picking of the buds commences in August and lasts for four months, and on an average each tree is picked three times in a season. The unexpanded buds on the trees are at first a pinkish yellow, becoming a deeper red as they mature. The stalks and buds are gathered at the same time, and thrown on to grass mats spread on the ground; the picking of the higher branches is done by means of triangular bamboo ladders.

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* 1 frasila = 35 lbs.

CURING.

Other slaves pick off the buds from the stalks, and they are then spread out to dry in the sun, being taken in every night. The cloves are dried on mats in direct sunlight. The drying is continued for the space of 6 days or one week.

Green cloves dry down to about half their weight; thus 1 frasila, green, is equal to ½ frasila, dry. The colour desired in the dry clove is red; and buds of this colour are more valued than black.

Cloves are dispatched to Zanzibar in gunny bags. There is a duty due to Government of 25 per cent.; this is paid in kind, and the cloves heaped in bulk in the Government godowns. Public auctions of this are now held by Government every fortnight to allow open competition, and especially to admit European merchants. Zanzibar cloves are very dry, differing much in this respect from the Pemba produce. Zanzibar cloves can be stored for some time, but Pembas are disposed of as early as possible, as otherwise the loss from "shortage" is very great.

A good dry sample of Pemba cloves is smaller and blacker—blacker from having contained much moisture. Zanzibar cloves are larger, and the red appearance of the dried buds is unmistakeable, and they are well-known as "Zanzibar red-heads."

SHIPMENT.

Cloves are generally exported in double mat-bags ("makanda") in preference to gunnies, though there is more shortage—in fact, the difference is marked; though double, the mat-bags apparently permit a greater absorption of damp. The difference of shortage between Zanzibar and Europe in the weight of the cloves equals 8 per cent. The difference between Zanzibar and Pemba cloves is well recognised in Europe, but large shipments of both varieties are also made to Bombay, where they are very probably mixed. Also large exports of clove-stalks are made to both Bombay and New York.

The exports of cloves from Zanzibar and Pemba for 1890–91 were as follows:—1890, 17,881,850 pounds avoir.; 1891, 13,615,105 pounds avoir.

At the present time Zanzibar unfortunately holds the lowest position in the London market as regards prices. I annex quotations of sales from the London produce market reports of May 13, 1892:—
" 77 packages Amboyna at 3⅜*d.* to 3½*d.* 388 bales Zanzibar (part
" sold) at 2⅝*d.* to 2¾*d.* Most of the 38 cases Penang sold privately,
" with a few lots in sale at 1*s.* to 1*s.* 0¾*d.*"

CCXCIV.—MISCELLANEOUS NOTES.

Appointment.—Mr. Thomas Humphreys, Arboretum Propagator at the Royal Gardens, has been appointed Assistant Superintendent of the Royal Horticultural Society's Gardens at Chiswick.

Vellozieæ.—The two genera *Vellozia* and *Barbacenia*, of which this tribe of *Amaryllideæ* is composed, are very poorly represented in cultivation, although they are plants of exceptional interest and decidedly ornamental in character. Altogether there are about 70 species in the two genera, all natives of South America, Africa, and Madagascar. At Kew the following only are represented by living examples, viz.:—*Vellozia elegans* and *V. retinervis*, *Barbacenia candida*, *B. squamata*, *B. purpurea*, and two unnamed Vellozias. We are indebted to Mr. R. Templeman, of Cape Town, for stems of *V. retinervis*, and also to Mr. E. Galpin, of the Transvaal, for good seeds of this species. Mr. Templeman writes:—"The Vellozias were collected by me in the Transvaal at a place about 40 miles from Pretoria, in very dry situa-" tions, where the winter is cold and there is no rain from March to " October." Mr. Galpin described the plant as "subarborescent, " branching, the stem 3–4 inches in diameter and 1¼–2½ feet high. " It is surmounted by a tuft of hard grass-like ribbed leaves, amongst " which spring the single-flowered peduncles, of which each stem will " bear a dozen or more. The flowers are handsome, lilac in colour, " and sweet scented." In a note on this species published in the *Gardeners' Chronicle* in 1876 (vol. vi., p. 837) the stem is described as being 12 feet high by 4 inches in diameter, and the leaves 5 feet in length. *Vellozia elegans* and *Barbacenia purpurea* are old garden plants. *B. candida* and *B. squamata* have recently been introduced to this country from Brazil. The arborescent species may be described in a general way as having stems like *Cordyline*, leaves like *Pandanus*, and with large campanulate white, blue, or violet flowers.

Melon Pear.—Under the name of Melon Pear or Pepino a Solanaceous plant was introduced to this country a few years ago and grown experimentally both at Kew and at the Royal Horticultural Society's Gardens at Chiswick. The stem was slightly woody at the base, but it had a loose bushy or scrambling habit indicating that it might become a weak climber, and so suggest the name of "vine" given to it in America. The fruit was somewhat egg-shaped, about 3 to 5 inches long, and having very much the appearance as well as the texture of a papaw fruit. The plant was received here as *Solanum guatemalense*, but as this name could not be traced it was evidently only a garden name. The correct name is *Solanum muricatum*, Ait., and it is apparently a native of Peru. As long ago as 1714 Feuillée described and figured it in his *Journal des Observations*, Vol. 2, pl. 26. He stated that in taste it closely resembled the ordinary melon. It has recently been figured as *Solanum muricatum* in *Garden and Forest*, April 13th, 1892 (Fig. 26). There appears to be considerable difference of opinion as regards the value of the fruit. Grown under glass in this country it was decidedly an inferior fruit, and the Fruit Committee of the Royal Horticultural Society was of the same opinion. It had a mawkish insipid taste rendering it quite unsuitable as a dessert fruit. On the other hand it appears to be regarded in California as possessing refreshing properties, and to be little inferior to a good melon. A writer in the *American Orchard and Garden* quoted in the *Gardener's Chronicle*, April 21st, 1888, is of opinion that "there is no fruit in the tropics or " semi-tropics which so readily allays thirst as the Pepino. When " properly grown it contains, beside the sugar, an acid of the most " refreshing and remarkable kind. A single ripe Pepino will allay thirst " for several hours even in the hottest weather. If grown under too much " heat this acid is more or less wanting, and the Pepino becomes worthless " or insipid, and resembles then simply an inferior Musk Melon." It is possible that in the peculiar climate of mountainous districts in the tropics the Melon Pear may prove useful. It probably requires similar conditions to such sub-tropical plants as the Tree Tomato (*Cyphomandra betacea*), the Chocho (*Sechium edule*), and the Cherimoyer (*Anona Cherimolia*) described in the *Kew Bulletin* for August 1887.

Attar of Roses.—It is well known that the great centre of the production of Attar, or Otto, of roses occupies the northern portion of the old Turkish province of Eastern Roumelia. The cultivation of roses for this purpose is, however, limited to the southern slopes of the Great Balkans, as the flowers are nowhere produced successfully on the north. The distillation of the petals is carried on in a very primitive manner with a copper still of the simplest construction. The first runnings are returned to the still and the second are received into glass flasks, where they are kept for a day or two at a cool temperature to allow the oil to rise to the surface. From the latter it is skimmed by a small tin pipette or funnel, with a long slender handle attached to the top and a very small aperture at the lower pointed end. This funnel is not more than ¾-inch diameter at the widest part, so that it is easily inserted into the flask, and plunged below between the oily layer and the water. It is then at once brought up, and it brings with it a portion of the oily stratum with a small quantity of water. The water escapes through the small hole at the bottom, while the oil or otto is emptied into the collecting flasks. For exportation the commercial attar is transferred to flat circular zinc receptacles known as "coppers," which are carefully sewn up in white felt and sealed with the exporter's stamp, the brand being also stencilled on the felt outside. Two of these "coppers," one covered with the felt, and the other without, are contained in the Museums of Economic Botany at Kew, and to these Messrs. Piesse and Lubin have now courteously added a specimen of the pipette or funnel for the purpose of making the collection more complete. As regards the identification of the plants cultivated for Attar of Roses, it may be useful to mention that in 1874 the late Mr. Daniel Hanbury, F.R.S., presented to the Kew Herbarium specimens of "Roses cultivated on the slopes of the Balkan for the production of Attar of "Roses," received from Mr. Vice-Consul Dupuis of Adrianople. These contained specimens of two species, a red rose (*R. damascena*, Miller), and a white rose (*R. alba*, L.). Neither of these is known in a wild state, and there can be little doubt that both are hybrids between *R. gallica* and *R. canina*. The subject is more fully discussed in *Pharmacographia* (1879), p. 262.

Gift of rare and valuable Books.—Mr. Thomas Hanbury, F.L.S., of La Mortola, Italy, has presented to Kew a selection of about 30 volumes, in memory of his brother, the late Daniel Hanbury, F.R.S. (part of whose library they formed) an accomplished botanist, who successfully devoted himself to the investigation of the sources of vegetable drugs. He published, in conjunction with Prof. Flückiger, of Strassburg, "Pharmacographia," which will long remain the standard and classical authority on the history of drugs. The portion of his library now acquired by Kew is of especial interest as having been used by him in the preparation of his book. Most of the books treat of economic or medical botany, and several of them are of very early date. A fifteenth century translation of an Arabian author (Serapion) on medicinal plants is of special value. As Meyer states (Geschichte der Botanik, iii. p. 235), the translation is in atrocious Latin, abounding in elisions and abbreviations. There is no separate title-page, the title being at the head of the first column, the whole work being beautifully printed in double columns, on paper of admirable quality. It runs :—

> Liber Serapionis Agre
> gatus ī mediciīs simplicib' Trāsla-
> tō Symōis Ianūesis interp̄te Abraā
> iudeo tortuosiēsi de arabico ī latinū
> Inquit Serapion.

This first edition was printed at Milan, as recorded at the end :—Opus Impressum Ml'i Per Antūium Zarotum Parmēsem Anno domini Mcccclxxiii Die Mercur̄i iiii August. There were several editions, but the first appears to be exceedingly rare. Indeed, neither Pritzel nor Dryander mentions it. Dryander (Cat. Bibl. Banks., i. p. 277) enumerates only a Venetian edition of 1552. Pritzel gives only the Brunfel's edition, published at Strassburg in 1531. This, according to Meyer, is the edition usually cited, as it is easier to read and has an index, which is wanting in previous editions. The first edition is a small folio of 370 pages, not numbered; and the sheets have no signatures, and the pages no catchwords, so that it is difficult to ascertain whether the sheets are arranged in proper order.

"Das Destillier Buch das Buoch der rechten Kunst zu distiliiren," a curious book in this collection, first appeared in 1500, and again in 1505, under a somewhat different title; and another edition was published in 1512. The edition in [the Hanbury gift was printed in 1515. The title-page and part of the preface are wanting in this copy, and here and there a leaf is imperfect, otherwise it is in excellent condition. Appended to the foregoing is " Das buoch des lebens Marsilius Ficinus von Florenz " zu dem gesunden und langem leben der rechtē arzneien von latin erst " nüw zü tütsch gemacht." At the end is the following record :—Gedruckt vnd vollendet ist diss loblich werck zu Strassburg durch Johānem Grüninger off sāt Adolffs tag. Imiar MDXV. Concerning the 1505 edition of this work Pritzel (Thesaurus Literaturæ Botanicæ, ed. 1, n. 4457) says :—In præfatione auctor de se ipso haec scribit : "Ich " *Hieronymus Brunschwyg*, des geschlechts *Salern*, bürtig von Strass- " burgk." De vita autoris, qui ***Brunschwick***, ***Brunsvigius***, ***Brunsvicensis***, ***Brunschwig***, ***Brunschwyg***, *Braunschweig* variis varie audit literatoribus, nihil certi constat. Ejus liber innumeris redit impressus vicibus, praesertim cum ***Marsilii Ficini*** Buch des Lebens "als er an im selb bewert und hundert und zehen jar rüwiglichen gelebet hat." The woodcuts representing the plants described in the first part are mostly very rude; but the scenic illustrations of the second part are excellent specimens of the art. The figures of persons are especially good. According to Treviranus (Die Anwendung des Holzschnittes zur bildlichen Darstellung von Pflanzen, p. 6), the figures of plants are all taken from the "Ortus Sanitatis."

Another very interesting book in this collection is "The Treasury of " Evonymus, conteyninge the wonderfull hid secrets of nature . . . " . . . . Translated (with great diligence and laboure) out of latin, " by Peter Morwyng felow of Magdaline Colleadge in Oxford." Imprinted at London by John Daie, dwelling over Aldersgate, beneath Saint Martines. "Cum privilegio ad imprimendum solum." The book opens with an address by John Daye " to the Christian Reader," dated 1559. This book is a translation of Conrad Gesner's " Thesaurus de Remediis Secretis," Lugduni, 1555. It is illustrated by neat little woodcuts mostly recognisable, though sometimes oddly named; and the same cut is sometimes made to do duty for two or three different things. Thus, the figure representing "*Fraxinus*" is repeated under "*Tilia.*"

Araucaria imbricata.—A tree of considerable historic interest died last autumn in the Kew Collections. It stood on lawn L. on the south-west corner of $\frac{8}{D}$ in the Key Plan. It was the oldest specimen of the Chili pine existing in this country, and for many years, before the species became so common as it is at present, it was regarded, according to Scheer, as "the lion of the gardens." It had had an eventful career, and for many years what was once "a superb tree" had lingered on as mere historic curiosity. The following account of it was given in the *Kew Bulletin*, 1891, pp. 299–300 :—

Menzies introduced the now well-known *Araucaria imbricata.* Smith (Records, p. 287) tells the story :—

"At a dinner given by the Viceroy of Chili to the captain and officers of the ship part of the dessert consisted of nuts which Menzies (who was a good botanist) had not before seen. Instead of eating all his share, he took some with him on board, and having obtained a box of earth, planted them, when they sprouted, and he succeeded in bringing five plants to England, which were safely received at Kew. . . . . In 1833 King William IV. presented one to Lady Granville for her collection at Dropmore. It was then about 5 feet high, growing in a tub; it is now (1880) a fine tree 60 feet high; this is, however, much inferior to another plant at Dropmore, said to be the produce of a cutting stolen by a lady from the original plant at Kew nearly 50 years ago."

According to Loudon (Arboretum, vol. iv., pp. 2435–6) :—

"Menzies . . . . brought home living plants, which he presented to Sir Joseph Banks, who planted one of them in his own garden at Spring Grove, and sent the others to Kew. From this circumstance the tree was called at first in England Sir Joseph Banks's pine. The tree at Kew was kept in the greenhouse till 1806 or 1808, when it was planted out where it now stands by Mr. McNab, the present (1838) superintendent of the Edinburgh Botanic Garden. After it was planted out, not being considered quite hardy, it was protected during winter with a temporary frame, covered with mats; and having become habituated to this mode of treatment, it has been considered unsafe to leave it off."

The unfortunate tree seems always to have had a bad time. Neill, writing in 1817 (Horticultural Tour, p. 77), says :—

"The most magnificent specimen of Chili pine (*Araucaria imbricata*) at Kew Gardens was irretrievably injured by its presence at a single gala at Carlton House, owing to the servants having very imprudently attached lamps to the branches of the tree."

Scheer, writing in 1840 (pp. 41, 42), refers to the original specimen of *Araucaria imbricata.*

"Still the lion of the gardens, King William, who, in his frequent visits to Kew, never omitted going over the Botanic Gardens, and latterly, when walking became inconvenient, drove through them in a pony phaeton, and at all events looked into every house, delighted to point out this superb tree to such strangers as might be with him."

It is anything but a "superb tree" now, and only lingers on as a historic curiosity.

Liberian Coffee.—After a long period of stagnation, the cultivation of Liberian coffee (*Coffea liberica*) is likely to become more general. This coffee is a native of the West Coast of Africa, the plant attains the dimensions of a tree, and it will grow in the lowlands in the tropics where the more heat and moisture it receives, the better it thrives. It will also grow in certain localities up to about one thousand feet elevation; but it is not suitable for cultivation on such high mountain slopes as are found so advantageous for the ordinary coffee (*Coffea arabica*). Particulars respecting the cultivation of Liberian coffee have been given in the *Kew Bulletin* (1888, p. 261; 1890, pp. 107 and 245); and latterly in the number for November last, pp. 272–282, it was shown from results obtained in the Straits Settlements that a gross return, over a wide area, at the rate of 42*l*. to 52*l*. per acre could be realised. In the West India Islands and other colonies in tropical America, where the coffee leaf disease has not yet appeared, the prospects of planting enterprise in Liberian coffee are promising. Even where the leaf disease is present, as in Java, Liberian coffee is found with present prices to be a very remunerative industry. In a report by the United States Consul on the trade of Java for 1891 it is stated that "The " cultivation of Liberian coffee has this year again attracted considerable attention, and if the planting of this description continues at the " present rate, the production in a few years will be a very important " one. Owing to the high prices which consignments of Liberia have " commanded, and the low rates which have ruled for tea, some planters " are gradually abandoning the cultivation of the latter in favour of " the former."

Beefwood Trees in West Africa.—In a note in the *Kew Bulletin* for 1892, p. 73, attention was drawn to the great value of the BEEFWOOD TREE (*Casuarina equisetifolia*, Forst.) for planting on sandy shores in tropical countries. At the request of the Government of Lagos, considerable trouble was taken at Kew to obtain seed of this tree from Madras for distribution to West Africa. In a report on the sanitary condition of Lagos in 1891 Dr. Rowland states:—" Another tree which " has been planted on the Embankment is the Beefwood (*Casuarina* " *equisetifolia*), which is of very rapid growth and seems to prefer " a sandy and saltish soil. This tree might be advantageously cultivated " on the borders of the swamps where the Eucalyptus would not " succeed. A large number of these trees were planted around the " race course, but owing to negligence nearly all have died. The trees " on the Embankment are loaded with fruit so that they can now be " multiplied to any extent." In a despatch from Sir W. Brandford Griffith, K.C.M.G., Governor of the Gold Coast, dated 16th September 1892, it is stated:—" It will be seen that at the present time there are " at the Botanical Station about 5,000 young plants of the Beefwood " Tree on hand. It is proposed to put them into bamboo pots, so that " they may be ready for distribution and planting at the commencement " of the rainy season. The Curator states that he will then have 10,000

" plants ready for transplanting into permanent places, when care will " be taken to have them distributed to suitable localities." The results from the Gambia and Sierra Leone are so far disappointing. This is owing to the fact that, in the absence of a Botanical Station, there is evidently no one possessing the requisite knowledge to undertake the work of raising seedlings and of caring for them until they are ready to be planted out.

British Fungus Flora.—Mr. G. Massee has published the first volume of a new synopsis of all the fungi hitherto detected in Great Britain. This volume contains the first part of the Basidiomycetes, including the genera *Lycoperdon*, *Boletus* and *Polyporus*, and the *Agaricineæ*. It is wholly in English, and, in addition to the descriptions, critical notes by various authors are given under many of the species. Spore measurements are given of all the type or authentic species in the Kew Herbarium. It is twenty-one years since a complete British Mycological Flora was published, namely Cooke's "Handbook," and during that period the number of known British fungi has been nearly doubled. That work contained 2,810 species, and Mr. Massee estimates the present number at 4,895, so that a new work is very much needed. In fact, students of mycology in this country have been at a standstill from the want of a complete synopsis.

ROYAL GARDENS, KEW.

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CCXCV.—PALM WEEVIL IN BRITISH HONDURAS.

(*With two Plates.*)

I.—INTRODUCTION.

The industry of cocoa-nut palm growing, established within recent years in British Honduras, has been seriously discouraged during the past five or six years by the attacks of the insect commonly known as the Palm Weevil on the trees, a large proportion of which have been killed.

In the year 1888, the Government of British Honduras recognised the fact that the annual loss thus incurred menaced the prosperity of the Colony, and therefore appointed a Commission to examine into and report on these attacks.

The Commissioners issued their report (26)* early in 1889, and the Government, acting upon the recommendations contained in it, issued a draft ordinance. This ordinance, which was designed to enforce under penalties the destruction of attacked trees, and was of a very stringent character, was not persevered in and did not become law.

A defect in the Commissioners' report was the absence of any evidence of steps having been taken to identify or describe the insect concerned, or to submit it for the purpose of being examined by a competent entomologist. In order to remove all possibility of doubt as to its identity, the Government of British Honduras sent over a series of specimens. These consisted of the cocoons and of the pupæ preserved in spirit of the American Palm Weevil or of an allied species, but in the absence of perfect insects they could not be exactly determined.

In the autumn of 1892, specimens of the mature beetles were received at the Royal Gardens, Kew, both from the Government and from Mr. C. T. Hunter, of Belize, who is largely interested in the industry concerned.

The specimens belonged to two species of weevils, of which the majority were, as was anticipated would be the case, examples of the well-known American Palm Weevil (*Rhynchophorus palmarum*, Linn.).

It was then decided to publish an account of the known habits and economic treatment of this insect, so as to present them in a convenient form for the use of planters engaged in cocoa-nut palm growing, who, according to the Commissioners, appear to be generally "unacquainted with the various stages in the existence of the Weevil;" and to serve as a guide towards obtaining a more thorough knowledge of the insect's habits and of the class of measures most efficient in keeping it in check. The present paper has been written and is published as the result of that decision.

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* This and similar figures in the text refer to the bibliography at the end of this paper.

As the insect under consideration, as well as the species immediately allied to it, is confined to tropical or sub-tropical regions, and no observations whatever can be made in this country upon its habits or life-history, the present account is of the nature of a compilation, and the accuracy of much of its information depends upon and is limited by that of the records supplied by investigators in tropical countries. That information is necessarily deficient in some respects, and the responsibility of adding to and correcting it rests with those engaged in cocoa-nut growing, who have opportunities for testing the statements made.

However, the comparison of accounts written by individual observers both of this insect and of allied species is most valuable in order to bring out the importance of certain facts and to check erroneous conclusions arrived at by persons who have no previous experience of such questions to guide them.

In order to keep the text free from technicalities, which are confusing to a non-scientific reader, these have been reduced to a minimum, and terminology and systematic descriptions have been relegated to a final section, while a certain amount of information which is already familiar to the cocoa-nut planter is given to complete the account for other readers. This course has necessitated some unavoidable repetition of descriptive facts.

The order adopted is as follows: firstly, a summary of the materials upon which the following account is based; secondly, a description of the life-history and habits of the Palm Weevil in all its stages; thirdly, a discussion of the economic features of its attacks; and lastly, practical suggestions.

At the end is a list of those works and reports in which the life-history of the Palm Weevil is mentioned at greater or less length, and of some others to which reference is made. It has not been thought necessary to give a list of all the older works on insects in which this insect is referred to. Such accounts are frequently copied from some other source and are of no value. A fuller list will be found, if desired, in Schönherr's *Genera et Species Curculionidum*.

II.—Sources of Information.

The Palm Weevil of Central and South America (*Rhynchophorus palmarum*, Linn.) is one of the tropical insects, with which zoologists have been longest familiar, for Mdlle. Merian, in her remarkable *Dissertation sur la Génération et les Transformations des Insectes de Surinam*, &c. (1) published in 1726, gave a good and recognisable drawing of the beetle, and of its grub, which she described as follows:—

"The Dutch name it *Palmyt-Worm*, that is, the Worm of the Palm, because it feeds on that tree. In the trunk of the palm tree swarm certain worms feeding on the pith. At first no larger than cheese-maggots, they grow like the one here represented. Certain folk grill them, and consider them a most savoury morsel. From this worm comes a black beetle, such as I have depicted, which the Indians and the Dutch both call the *Mother* of the palm worm" (p. 48).

The insect having become known at this early date, was figured in many of the early works on entomology down to the present century, and received from Linnæus the scientific name of *Curculio palmarum*. Linnæus' large genus *Curculio* was soon split up by zoologists, and the palm-weevil has been called by Herbst *Rhynchophorus palmarum*, and by Fabricius *Calandra palmarum;* both names are common and used to denote the same insect, but the former is now definitely established and accepted. Other generic names proposed for it have never come into general use.

The early entomologists worked out the position of the insect in classification, but added nothing to Mdlle. Merian's account, upon which they were content to draw. The fact of the grub or *gru-gru worm* being eaten by the natives and even by Europeans proved of more interest than its injurious habits, then of little importance, and certain ingenious statements were made, with an apparent disrespect for geography, to show that it was the Cossus of Pliny and the Roman epicures. Many authors (1, 3, 6, 9, 11), among whom are Kirby and Spence, and Schomburgk, speak of the grub being served as a delicacy, and it is obtainable by epicures of the present day at some of the West Indian hotels particularly in Martinique. This interesting fact need not be further dwelt upon, for it is improbable that there will be a sufficient demand for this dainty to counterbalance the insect's capacity for destructiveness; but if it should become popular as an article of food in Honduras, a certain additional impetus will be forthcoming to the work of searching for and destroying, or rather collecting, the grubs.

In 1828, the Rev. Lansdown Guilding, in a valuable but rarely consulted paper (3), described briefly the injuries which this weevil inflicts upon sugar-cane, as did Sir Robert Schomburgk in his book on Barbados (11) published in 1847.

From that date, and owing to the increased importance of tropical agriculture in modern times, scattered references to it as an injurious insect are to be found in different works, but the only detailed account of its habits appears to be that presented to the Government of British Honduras in 1889, in the Report of Messrs. Phillips, Bellamy and Dr. Gabb (26). In 1880, Miss Ormerod gave particulars of its attacks on sugar-cane in British Guiana (19). There are some valuable notes on it in *Insect Life*, U. S. Department of Agriculture, contributed by Mr. J. B. Hickey and the editors (32); and information is given in the same journal (25), and by Mr. S. V. Summers in the *Canadian Entomologist* (13), on a closely-allied species, the Palmetto Weevil, *Rhynchophorus cruentatus*, Fabr. (= *Zimmermannii*, Fåhr.), a native of Florida and the Southern States of North America.

The above form the principal sources of information, together with particulars given in conversation with the writer by Mr. C. T. Hunter, of Belize. These have been most valuable in several respects.

Besides the American Palm Weevil, there is another and distinct species, the Asiatic Palm Weevil, or "red-beetle" of the planters, (*Rhynchophorus ferrugineus*, Fabr.), a native of India and the Malay region, which also attacks the cocoa-nut palm, and closely resembles its American congener in habits. There has always been a tendency on the part of writers to confuse these two species, a tendency which no doubt has caused the geographical vagaries referred to. Though closely allied they differ in appearance, if not in habits; and it is desirable to remember that writers who speak of the Palm Weevil in Asia as

Rhynchophorus or *Calandra palmarum* are referring to *R. ferrugineus*, and not to the American weevil.

Attention to this point is necessary, particularly in the study of periodicals devoted to tropical agriculture, in which the mistake is constantly made.

It is desirable to examine into the habits of both species together in order to solve the problems which they present, but caution is necessary in the comparison and in reconciling any discrepancies which they may present. At the same time the writer cannot point to any well-marked difference in their habits.

The information on the Asiatic Palm Weevil consists of letters to *The Tropical Agriculturist* (21), for the most part reproduced in *All about the Coco-Nut Palm* (22), and of short accounts in other agricultural works (24, &c.); also of reports made to the Government of the Straits Settlements, who proposed an ordinance similar to that of the Government of British Honduras. The best of these is a valuable one by Mr. H. N. Ridley, F.L.S., Director of Gardens and Forests, Singapore (30). There are also various letters in newspapers of that colony (27).

III.—HABITS AND LIFE HISTORY OF THE PALM WEEVIL.

The Palm Weevil is one of the largest insects contained in that very important and extensive group of beetles, the Weevils, of which the most characteristic feature is the prolongation of the head forwards so as to form a snout or *rostrum*, sometimes of great length, into the sides of which the horns or *antennæ* are inserted. The snout, which is always distinguishable in the true weevils, bears at its extreme tip the mouth, very small but nevertheless efficient.

The mouth is used for feeding, and by the females in drilling holes, which operation is rendered possible by its position at the end of the snout, or in nibbling patches from the rind of plants in which the eggs are then laid. There has been a good deal of misunderstanding about the snout of the Indian Palm Weevil, and it has been several times said that that insect possesses no alimentary apparatus whatever. This is not the case. The beetle, like other weevils, which are, as a rule, long-lived insects in the adult state, can and does feed, and the observer, mindful of the elephant, has probably looked for the mouth under the head, at the base of the snout, which he has taken to be merely a horn with penetrating power limited by the force with which the beetle can drive it in. The insect can pierce far harder tissues by gnawing than it could ever do by mere pushing.

Weevils possess a hard convex body of oval or cylindrical shape, rigid slowly-moving legs, and four-jointed feet, with broad flattened soles. Like other beetles, they pass through a series of transformations after leaving the egg, and before becoming adult. The first stage after the egg is that of the *larva*, or grub, in which all growth, that is, all increase in weight or bulk, takes place, and this stage is commonly the one in which the insects, feeding voraciously, are actively injurious. But sometimes the mature weevils are more mischievous than their grubs.

A weevil grub always feeds away from the light in the inside of a plant, in the seeds, wood or stem, the leaf substance, &c., and, like other internal-feeding larvæ, is white or yellowish. The head, of a darker colour, is well developed, stout and horny, with strong jaws, and is somewhat vertical, with the mouth situated below. The body is short and thick, swollen in the middle, and tapering at either end; it is generally much wrinkled, and bent into a more or less conspicuous curve, so that the under side is concave. Legs are entirely absent, or are at most represented by six small tubercles on the three rings succeeding the head, so that the grub can only move in its burrow by the writhing of its body, and in some kinds by the assistance of horny projections with which the tail is furnished.

If attention is paid to the above features, it is easy to distinguish a weevil grub from that of any other insect, but the points of difference between the larvæ of different weevils are small, and but little known, so that great caution is necessary in determining a larva of which the identity is doubtful.

When the grub has become mature by continuous feeding, broken, however, by intervals when it changes its skin and emerges from its old garment clad in a new and larger one, it transforms by a further change of skin into a *pupa*. This takes place near the surface of the plant, so that the perfect insect, whose burrowing powers are in most of the true weevils limited, can break without difficulty through the structures which shield it from the air.

The *pupa*, sometimes enclosed in a cocoon or covering constructed by the grub, resembles the perfect insect, but is soft and pale with the wings and limbs neatly folded down on its under side. The limbs are separately enclosed in a thin skin which is not continuous over the surface, as in the pupa of a moth. As a pupa the insect lies dormant for a shorter or longer time, taking no food and being absolutely harmless. At last the perfect beetle, which has slowly matured in the pupal covering, throws it off and issues forth. It is at first soft and pale, and remains in shelter till its outer integuments have hardened, when it sets forth on its work of feeding and reproduction.

If an American Palm Weevil is carefully examined from above, it is seen to be a large oval beetle with its upper surface slightly flattened and of a deep velvety-black, with little or no lustre. Specimens which are glossy appear to have lost their velvety pile by being rubbed, and have probably emerged some time ; they frequently have a shiny streak along the middle of the back, while the sides are dull. Three main divisions can be made out in the body ; the *head*, prolonged into the beak ; the *thorax*, extending from the head to the wing-cases, and gradually becoming wider ; and the hind body, or *abdomen*, which completes the body, and is covered, except for its last quarter, by the ribbed wing-cases, or *elytra*, which, when the animal is not flying, meet each other accurately along the middle line of the back, except for a small triangular piece at their base (the *scutellum*), and are of the same horny consistency as the rest of the body. They cover over the much larger hind wings—the pair used in flight—which are folded up underneath.

The *head* is short and small, except for the beak, which extends forwards and downwards in a gentle curve, and bears the small mouth at its tip. In some specimens the snout is slender, and its base is studded with small distinct punctures ; in others it is stouter, the punctures are coarser, and tend to run together, so that the surface is wrinkled, and there is a slight ridge or keel along the middle of its upper surface, which runs forward into a somewhat flattened space near the tip. This space bears a dense brush of short black hairs growing vertically upwards, and looking as if they had been trimmed off with a pair of scissors. The latter insects are males ; those with the slender hairless snouts are females, and the distinction is of great importance, as the only one that can be relied on to separate the sexes. It can always be made out with a little practice, even in males that have worn off the brush of hair. The female is on an average slightly bigger and bulkier than the male, and there are minute differences in the structure of the hind segment, but these are not to be depended on. The statement that all the larger and more bulky specimens are females is wrong; both sexes are very variable in size.

At the base of the snout are inserted the *antennæ* or horns, constructed of eight joints, the first of which, as in most weevils, is long, and set at an angle to the rest; the following six joints are small and bead-like, and the last is large and flattened, and looks as if it had been cut off abruptly, having a soft and spongy terminal surface.

The *thorax*, strictly the pro-thorax, and only the anterior part of the true thorax, which can be seen on the under side to extend as far as the hind legs, is apparently made up of one piece without join except for the insertion of the fore legs, another feature characteristic of the weevils.

The *legs* are short and powerful, the hinder pair being attached to the body very far back; each consists of a thigh, a shank, and a four-jointed foot.

The shank is not set with spines except at the apex, where there is one directed inwardly.

The structure of the weevil is not adapted for burrowing into hard vegetable tissues, and it does not do so, though it may creep into crevices, or dig its way into loose, rotten material and soft structures like the split cabbage of a palm, in which they are sometimes found. In boring beetles the body is narrow and cylindrical, so as to fit the burrow, and the snout, if present, is short and strong, while the shanks, as a rule, are strengthened with teeth or spines set along their outer edge, sometimes for excavating, usually to resist the friction of burrowing, and to throw out of the burrow the débris that is bitten away. The Palm Weevil, with its unarmed shanks and its very small mouth, would have great difficulty in making a hole big enough to accommodate it in the trunk of a tree, and when specimens are found inside a tree, they have got there either through a wound, by entering the hole of another insect, or the soft parts of the split bud, or have been bred in the tree and not yet quitted it. In the latter case the immature beetles will be found near the surface with a thin layer of rind between them and the outer air, through which they can easily break. One observer speaks of finding the "parent beetle and three large grubs wrapped in the fibre about three inches from the bark" (26). The beetle certainly was not the parent of the grubs, and it must be distinctly borne in mind that, except perhaps when the tree has external wounds, the beetle does not bore but lays its eggs from the outside.

The perfect weevils are mainly nocturnal in habit, and fly at dusk or by night with a loud booming noise (the Indian weevil is said, however, to fly frequently by day as well) (27). They hide from daylight in rubbish at the foot of the trees, and occasionally, it is stated, burrow in sand (26); they are also to be found concealed in the folds of the leaf-sheaths and the matted fibre of the head of the tree, or in the holes made by other insects. They feed freely on decaying sap or fruit, such as mangoes or bread-fruit, and on the rotten tissues of the palm-cabbage and pith, to which they are attracted by the smell of the fermenting juices, a circumstance that affords the readiest and best means of capturing them.*

In the adult state they are not known to injure the palms for the purpose of feeding, and as they are the parents of further broods of destructive grubs, the chief point for study in their habits is the method of egg-laying, which is regulated by the instinct of the insect to place its eggs in a situation where the inactive grub can, upon hatching, get the food it requires.

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* They also frequent freshly-planted sugar-cane sets, in which the female deposits her eggs; this habit is as yet unrecorded from Honduras.

Whether a tree is selected for egg-laying in preference to others is obviously determined by its condition at that time. As a rule, the act of egg-laying passes unnoticed, and the health of the tree only becomes a subject for inquiry some time later, when the work of the grubs is apparent; and the inquiry is therefore complicated by the necessity for distinguishing between an unhealthy condition occurring as a result of the infestation, and one which may have originally brought it about.

The female is stated to lay her eggs singly, in accordance with the habit of other weevils, by perforating the rind of the tree and depositing an egg in the hole made. The appearance of the eggs and the number laid by each female have not yet been recorded.

It is desirable to know the exact spot selected for oviposition in order that it may be artificially protected. At present the evidence does not place it beyond doubt. It is generally admitted that eggs are not laid in the leaf-stalks nor upon the leaf-spike, when their hard silicious surface is unbroken; and the laying of eggs on the stem is limited below by its maturity, and the consequent presence under the rind of hard wood, for the grub is not a hard-wood feeder, but devours the pithy interior of the stem, and, as before stated, the beetle will not lay its eggs where the young larva cannot get its proper food.

The vulnerable point lies, therefore, about the upper part of the stem, below the attachments of the leaves, and above the woody portion. In young trees, where the wood has hardly begun to form, and the stem is only from one to three feet long, any point above ground is open to attack, and even, according to Mr. Bellamy, below it (28). But fuller evidence is required in support of this statement, which may rest on the erroneous interpretation of observed facts.

In the Commissioners' report, Dr. Gabb states that out of the trees he examined "a large number . . . especially those which "were inclined to one side, or on other protected parts, [*sic*] had the "eggs of the weevil deposited in them near the ground on the under "surface."

Mr. Bellamy says "it lays its eggs in the inequalities of the bark "at or near the surface of the ground" (28).

These are all the particulars about its egg-laying, and no detailed evidence is given in support of them; this ought to be done to prevent subsequent doubt, for, unless the act of oviposition is observed, it is difficult to exclude the possibility of a mistake.

Even though any point between the head of the tree and the ground be equally open to attack in palms grown under perfectly natural conditions, there is in trees trimmed by the planter a weak spot readily available for egg-laying, and one where the majority of eggs are almost certainly laid.

The stout petiole which carries the palm-leaf widens out into a triangular base at its attachment to the stem, so as to overlap its fellow and encircle about one-half the circumference of the trunk; and the space between adjoining leaves is filled up by the coarse matted fibres of the leaf-sheaths. In this way the tender part of the stem is thoroughly protected above the line of attachment of the lowest pair of leaves.

As the leaves grow old they droop and hang down; and to improve the appearance of the plantation and to facilitate riding through it, it is customary to remove the drooping fronds by cutting through the stalks, or tearing them off at the point of attachment to the palm. In this way a portion of stem which forms a ring of about an inch in width between successive leaves is unduly exposed before the rind is mature. In cocoa-nut palms grown at Kew, this ring is pale, and its rind is tender and easily penetrated at least a year and a half after the protecting leaf-sheaths have been removed. It would harden more quickly in a tropical climate, but, nevertheless, this surface of immature stem is a spot that should be most carefully protected.

In the Commissioners' report, the practice of trimming the leaves is condemned, but a reason is not given, and cannot be inferred from the statements there made about egg-laying.

But in India this fact has been more generally recognised. Mr. Ridley writes about the weevil, "it finds its way to the base of the leaf-" stalk of the palm, and pushes the egg as deeply into the body of the " tree as it can. Some persons affirm that the beetle lays its eggs in " the base of the tree, and that the grubs then burrow upwards. I " have seen no case of this. . . . . I have certainly seen burrows " made by some insect in the old stems of the coco palm, but I do not " believe that they were the work of this animal, but probably of some " Longicorn beetle" (30).

All observers agree in condemning the practice of stripping off the old fronds, which by their leaf-sheaths so thoroughly protect the tenderest part of the stem. The simplest plan of dealing with them is to bend them down without breaking them, or even to tie them up. It is doubtful whether it is sufficient to cut off the fronds at some distance from the stem. If the stalks are not dry the exudation of sap from the cut ends probably attracts the beetles.

The female is also ready to take advantage of any wounds on the surface or cracks in the bark of the tree in which to lay her eggs. Such wounds may be made by other insects, for example in India by the Rhinoceros or Elephant beetle (*Oryctes rhinoceros*, Linn.), in the burrows of which into the head of the palm the weevils take shelter; they may also be caused by unskilful trimming of the leaves and fibrous sheaths, and thus afford another reason for giving up this practice. The cracking of the rind is to a large extent due to the same act which prematurely exposes it.

From the egg the grub, at first minute, hatches and begins to bore into the pith of the tree. An observer should be able to recognise the grub, and distinguish it, even when small, from other larvæ to be found in the palm, those of longicorn beetles and of other weevils especially. In several accounts of grubs being found in trees in various stages of decay, there is nothing to show that they did not belong to some other species of insect.

The larva, or *gru-gru worm* is, when fully grown, about two to three inches long, and of a yellowish-white or brownish-yellow colour. Its body is slightly bent and is very stout in proportion to its length, so that the skin when stripped off is nearly circular.

The head is large and horny, and the mouth is at its lower and anterior part; the jaws, which work, as in all insects, sideways, are short, stout and rather blunt. Its colour is a deep pitchy brown and the jaws are the darkest parts. It is set with a small number of bristles, and there are also a few on the hind segment, while the rest of the surface is hairless. The skin of the body is loose and wrinkled, and, if the underside be looked at, is seen to be thrown into 11 folds, so as to divide the body into 12 rings or segments. These folds are continued round to the upper side, where there is between most of them an additional transverse fold. The body is stoutest at the seventh or eighth segment and tapers sharply from the ninth to the tail.

The skin of the body is somewhat velvety in texture, but that covering the back of the first segment is horny, brown and polished, forming a shield-like protection, and the back and sides of the three following segments present a series of small irregular horny patches; these are the points where the skin, being much rubbed in burrowing, loses its velvety pile and becomes thickened, so as to form callosities, the shape of which depends on the surface wrinkling. The hind segment of the body is also horny and terminates in a flat plate strengthened at the edge with four bristle-bearing tubercles; above it there is a triangular depression with thick raised edges.

Insects breathe by holes or *spiracles* placed at the sides of most of the segments, one pair to each. The grub of the Palm Weevil has but two well-developed pairs, a most remarkable feature; the first pair are to be seen as distinct vertical slits at the lower ends of the horny shield which covers the back of the first segment, the last pair on the inner margin of the thick raised edges above the tail-plate are also conspicuous. (*See* VI.) Legs are only represented, if at all, by six small tubercles on the underside of the three first segments.

The shape of the hind segment, the position of the two pairs of well-developed spiracles and the large size of the full-grown larva, will probably distinguish the grub of the Palm Weevil from that of any other species, except a very few most nearly allied to it and of similar habits.

The boring of the grubs is said to be upwards, a statement that Mr. Ridley contests. They feed on the soft pith that fills the inside of the stem up to the growing point, and can be found in any part of it. The tree is killed by their feeding at the base of the cabbage and injuring the growing point, whereas damage done to the pith in the lower part of the stem does not necessarily prove fatal. There is some confusion as to their feeding in the head of the tree or not, due partly to the larvæ of other insects being mistaken for them, partly to a loose use of the term "cabbage," the limits of which are not taken to be the same by different observers. It is the pith immediately below the true cabbage that appears to form their favourite source of food. The grub in boring makes a tunnel corresponding to the diameter of its body and becoming larger as the latter increases in size. It does not make holes on the outside of the trunk which can serve as a conspicuous sign of its presence. When approaching maturity it returns to the outside of the tree, according to Dr. Gabb, by enlarging the channel along which it has come, a process that must necessitate its turning round in its tunnel. Arriving near the outside, it eats away the inner rind so as to leave a thin shell, "of "the thickness of foolscap paper," between it and the outer air, through which shell the beetle can easily break. It then retreats a little way and constructs a close oval cocoon of the fibres surrounding the pith, that is, of the fibro-vascular bundles running to the fronds. This cocoon is three or more inches long and about one and a half in diameter, and consists of a dense mass of interlacing fibres, mostly arranged circularly and suggesting a bird's nest. No gum or silk is employed in the cocoon, within which the grub casts its skin for the last time, and appears as a *pupa*.

The *pupa*, perfectly harmless—for it takes no food and cannot quit the cocoon—has a general likeness to the beetle to which it changes. It is light-coloured with a thin delicate skin; the snout, antennæ, legs and wings are neatly and symmetrically folded on the underside, the snout extending along the middle of the body, the two anterior pairs of legs doubled up and covering the wing-cases and wings. These are shorter than in the mature insect and lie over the hind legs, the wings projecting beyond the wing cases. The upper side of the abdomen is exposed and its spiracles are now conspicuous.

Under the investing skin of the pupa the beetle slowly develops its organs, and at last splits it and emerges. Soft and pale, it does not leave the tree at once, but waits until its integuments have hardened and have acquired their full colour. Then it breaks through the rind which shelters it and comes out as an adult weevil. A certain number are unable to escape from different causes and perish in the tree.

The holes made by the exit of beetles are conspicuous, and may afford the careless observer the first clear sign of the mischief that is going on. They occur anywhere in the soft part of the palm stem, and most frequently just below the head. Cocoons are not to be found in the cabbage, but only close to the outside in the neighbourhood of the fibre from which they are made.

The length of life of the perfect weevil and the time passed in the early stages have not been ascertained, nor have the periods at which egg-laying is performed. These points are less important in tropical than in temperate countries, where the life-periods of an insect are closely related to seasonal change. But in the tropics the dry and wet seasons, at least, influence the stages of insect-life, and an effort should be made to obtain accurate knowledge of matters which are of so great importance. Prevention of egg-laying for example is likely to be more successful if carried out in reference to the seasons of oviposition, should any such exist.

The Palmetto Weevil of the Gulf States of North America (a feeder on *Sabal Palmetto*) is said by Summers (13) to emerge as a perfect insect in September and October, to live through the winter and lay eggs in the early summer, the grubs being found in the latter part of June and July. Adult weevils are usually long-lived, and it is possible that the Palm Weevil lives nearly a year as a perfect insect.

Mr. Hunter believes that there is more than one brood a year, which is probable, and specimens in all stages are said to have been taken from the same tree (26). This would show that seasonal development is not well marked, but the observer may have been mistaken as to the identity of some of the younger specimens found.

IV.—Economic Features of the Palm Weevil.

In the preceding pages the appearance, habits and life history of this insect have alone been described. It is now necessary to discuss the economic questions involved, the appearance of the injured trees and the extent of the damage inflicted, the circumstances which favour the Weevil's destructiveness and those that tend to limit it.

The American Palm Weevil feeds on several kinds of palm, probably on almost any kind, particularly of the soft-stemmed palms; among the species it is known to attack are the Cocoa-nut palm (*Cocos nucifera*), the Cohoon palm (*Attalea Cohune*), the Cabbage palm (*Oreodoxa oleracea*), the Big Thatch palm (*Sabal umbraculifera*) and the Macaw Tree or Gru-gru palm (*Acrocomia sclerocarpa*).

It also attacks sugar-cane. Its range extends from South California over Central and South America as far as Brazil, and it is found in the West Indian Islands. The Indian species occurs throughout the Oriental region of naturalists (India, Borneo, Java, &c.), and is also a general feeder on palms, particularly on the Cocoa-nut palm and the Toddy-tree (*Phœnix sylvestris*) (35).

The range of the cocoa-nut palm is therefore wider than that of either insect, and being largely independent of human agency is so extensive—while its original home, which De Candolle finally considered as being in the Old World, is so doubtful—that it is now impossible to speculate on the length of time that the tree and either species of weevil have been in association. But whether it has always served as food for the American Palm Weevil or not, it is now perfectly clear that the insect is not dependent on that tree alone, and that *its extirpation could not be effected in Honduras by cutting down and destroying every single cocoa-nut palm in the colony.*

Honduras possesses as large if not a larger variety and number of palms than perhaps any other region where the cocoa-nut is cultivated, and the greater proportion of the country is in a wild state and cannot be dealt with by any economic measures; there, at all events, it would appear that the natural food of the insect consists of wild palms, from which its attention has been diverted to the cocoa-nut plantations.

Of these wild species the chief is the common Cohoon or Corozo palm, which does not grow in the same situations as the cocoa-nut tree, but in the rich alluvial soil of the Corozal, or cohoon ridges. These ridges are really depressions between the series of quartz elevations running more or less at right angles to the seaboard.

The cocoa-nut, a lover of sandy soil near the coast, is grown in plantations as a rule not nearer than five or six miles to the cohoon ridges, but which in some cases lie close to them. The land of the ridges is valued for banana growing, and for this purpose, and not for growing cocoa-nuts for which the soil is unsuitable, the cohoon and other palms have been extensively felled and allowed to lie upon the ground; this has resulted in a large increase in the numbers of the weevils, which have bred in the felled trunks. As long as they are feeding on wild plants they are not likely to multiply fast, because a balance will have established itself between the rate of increase of the trees and the causes tending to diminish the number of the beetles on the one hand, and the rate of propagation and destructiveness of the latter on the other hand—otherwise beetles or palms must gradually die out; and observers in Jamaica and India have noticed that the number of wild palms is not sensibly affected by the presence of the weevils.

But if this balance is disturbed by external causes such as the cutting of cohoon palms, which favour the weevils, a large increase in their numbers will result.

There is good reason for supposing that the extensive injury to cocoa-nut plantations is largely due to the swarms of weevils thus bred. In the Commissioners' report, Mr. Baber in his evidence states that he considers the proximity of a cohoon ridge to be a source of danger; and Mr. Hunter has informed the writer that little was known of the beetle until about 1888, a period which coincided with wholesale felling of cohoon palms in order to bring the ridges under cultivation.

As there is a particular age when the cocoa-nut becomes liable to attack, namely, at the time of its first bearing, between four and six years old, it is possible that there is merely a coincidence in time and no further connexion between the clearing of the ridge and the damage done to the palms on their approach to maturity. Mr. Schofield, however, states that among some 2,000 trees planted about seven or eight years previously only a few isolated cases of disease had appeared until the end of 1888, "some five trees altogether having succumbed to the attacks of "the bug" (26). This tends to negative the idea of a coincidence, for the majority of his trees must have reached maturity without being immediately attacked.

If the development of weevils has been thus encouraged, it will be difficult to check it by the destruction of the felled cohoon palms. Wild palms are so abundant that the removal of them, living and dead, is impracticable, and the interest of the banana planter on the cohoon ridge do not necessarily coincide with those of the cocoa-nut planter, so that he cannot be expected to go to the expense of destroying felled palms which do him no harm. The cohoon palm is a soft pithy tree that will not readily burn, even if that be the proper method of preventing beetles breeding in it. The destruction of felled palms will be considered later.

It is doubtful whether cocoa-nut plantations should be established at all in the immediate proximity of the cohoon ridges, and it is important that the amount of injury sustained by cocals at different distances from them shall be carefully compared, as this question must arise in the establishment of further plantations.

Mr. D. Morris, F.L.S., of Kew, made, when Director of the Botanic Gardens in Jamaica, some very important observations bearing directly on this point which it is desirable to quote in full (20) :—

"It has been remarked as somewhat strange that while the cocoa-nut palm grows freely everywhere along the coast of Jamaica, it is almost entirely absent from Alligator Pond to Black River, and, indeed, along the southern coast as far as Savannah-le-Mar. At first this was taken as an accidental circumstance, but careful inquiry on the spot has convinced me that although the soil and climate differ very slightly from those in other portions of the island where the cocoa-nut thrives luxuriantly, all efforts to establish it along the seaboard of the parish of St. Elizabeth, and especially in the Pedro district, have signally failed. The plants appear to thrive for a few years and to grow remarkably well, but before coming into bearing [or soon after] they suddenly die off from the top, leaving nothing but a bare frondless stem. After examining several trunks of the Big Thatch (*Sabal umbraculifera*), a palm which is very abundant in the district, and finding them completely riddled by the attacks of the larva of a beetle very closely allied, if not identical, with the destructive palm beetle of the East Indies, I came to the conclusion that one, if not the chief cause of the absence of the cocoa-nut palm was the abundance of this beetle. Further information and inquiry into the neighbourhood have fully confirmed this view. The Big Thatch appears to exist, and, indeed, to thrive luxuriantly in spite of the beetle, but the cocoa-nut fails. The terminal bud of the latter offers an easily accessible and tempting *bonne bouche* to the larva, and it succumbs to its attacks. On the other hand the Big Thatch thrives and covers the country.

"It seems as if in this instance a choice must be made between the Big Thatch and the cocoa-nut palm. The work of exterminating the former palm, covering several thousand acres, is an alternative which is neither practicable nor, for some reasons, is it indeed desirable. If the ravages of the beetle do not extend to other portions of the island it would, perhaps, be better to accept the inevitable and devote attention in this district to other plants of a more promising and remunerative character."

As before mentioned the palm does not prove attractive to the beetle till it begins to come into bearing at an age from four to seven years, when the terminal bud becomes larger and more juicy. At this period the tree has some three feet of stem, and it remains liable to attack until it is about 12 years old and has some 12 or 14 feet of stem. If it is free up to that age it is rarely attacked afterwards. The greatest damage takes place from the middle to the end of the dry season, that is, about July to September, and perhaps corresponds to a period of egg-laying at the beginning of the season. It has been stated of the Indian weevil (33), "insects of the above class multiply rapidly in times of protracted " drought, and it is during such periods of abnormal weather that they " commit the greatest amount of mischief."

An infested tree shows at first little or no signs of injury, unless the points at which eggs are laid are discoverable by a skilful observer. The Commissioners' report says that "by careful observation small " holes may be discovered with a little gum oozing from them, but by " that time the larvæ have attained considerable size and have eaten " their way far into the heart of the tree" (26). Mr. Ridley says of the Indian weevil :—"It works entirely inside the tree, and makes little or " no external marks. By listening at the side of the tree the grub can " be heard gnawing the wood. But usually the withering and fall of " the central shoot is the first sign that anything is wrong. In some " cases a tree exudes a shiny liquid, having an unpleasant sour smell, " which is a sign of serious damage"(30). To listen for the grub feeding may be more practical than it sounds; the ear should be placed against the tree, or against the end of a piece of seasoned deal, used like a stethoscope, with its other end on the trunk. Another account of the same insect, evidently from the pen of a careful observer, states that "if " the heads of the trees are frequently inspected by skilful beetle " searchers many trees may be saved by cutting out the grubs, their " presence being known by the searcher either finding a cocoon in " the tree or, more generally, by noticing slight wounds on the smooth " skin (if I might call it so) of the leaf spike, which are unintentionally " made by the grub in eating the soft pithy mass through which it " pushes its way" (27).

The origin of the small holes exuding gum, to which the Commissioners refer, is not clear, unless they are due to the grub having accidentally broken through the rind at that point. That the larvæ do occasionally penetrate the rind slightly is shown from the last account quoted, and from the good effects which sometimes at least have been found to follow the application of salt or lime to the head of the trees, which presumably acts by reaching the grubs through wounds in the silicious surface. There is just a possibility of the small holes being made by other insects attracted to a sickly tree ; and this point and the character of the external signs of injury, are worthy the attention of a naturalist who has had previous experience of the work of internal-feeding insects. Mr. Hickey mentions that after a rainy spell of a few days he has noticed a golden-coloured glue or sap running out of some of the trees, but he failed to find any borers in them (32). The whole matter deserves more complete investigation.

As the burrows of the grubs progress, and the vital part of the tree is reached, the fronds become discoloured and droop, and it is said that they turn red in a tree attacked by weevils, and yellow in one dying from other causes. The fact if true is important, and may be due to the drying up of the leaves from the loss of sap caused by the severing of the fibro-vascular bundles which supply them. The fronds and head die, sometimes from the first attack, sometimes from later ones, and the whole crown falls off leaving a leafless stump. The soft tissues of the head and trunk decompose and are filled with grubs, not only of the Palm Weevil but of other kinds of insects.

Mr. Schofield, on cutting open such a tree, "discovered two " large maggots, together with an enormous quantity of smaller " maggots of white appearance, and about ¾ to 1 inch in length. The

" inside of the tree was completely rotten and stank, presenting the " appearance of fresh dung or manure "(26). There is nothing to show to what species these maggots belonged.

The beetles will lay their eggs in felled trees, and the grubs continue to feed in them, at least so long as there is undecomposed pith for them to consume, and in this way a dead tree will continue to breed beetles for some time. But weevils are not as a rule attracted to vegetable matter that is far advanced in decay, and particulars are required of the length of time that a felled trunk will continue to attract the parents, and to serve as a place of growth for the larva of this particular insect.

Mr. Hickey says, "I cut down a small cohoon tree, very much " resembling the cocoa-nut palm, cutting it through the tender portion, " the bud. In two or three days it began to sour, and for a few " evenings, between sunset and dark, I noticed several of these beetles " fly to it and bury themselves an inch or more in the soft pulp, some " remaining there all day. In about 10 days they were all gone. A " month later I cut the stump off about 3 feet lower down and found it " full of holes, and some 10 or 12 worms the size of a man's thumb, " 1½ inches long, with a short hard head, resembling very much the " common grub worm "(32). It follows from this readiness of the insect to breed in stumps and fallen trees that the practice of cutting down injured palms at the height of 3 feet from the ground, and neglecting the stumps, is admirably calculated to increase the mischief, and on this point the evidence of Mr. Baber to the Commissioners may be given: "He saw no sign of damage on Long Reach Sittee until he " began thinning; the trees had been too thickly planted. When " thinning he left the fallen trees lying in the plantation, and considers " that they were or might have been a source of attraction to the " weevils, and that they ought to have been removed or destroyed. " The trees were about five years old when he thinned them, and very " soon after he noticed signs of their being attacked; in about four " years he lost fully 1,000 trees out of a plantation of 2,500; during " that time he was constantly cutting down and destroying trees" (26).

Mr. Phillips says, "The plan I adopted was to cut the tree " down to about 3 feet off the ground as soon as it showed any signs " of being attacked by the weevil, but the leaving of the stump in the " ground added to the danger of infection rather than diminishing it"(26).

The destruction of trees on Mr. Baber's plantation amounted to nearly 40 per cent., that on Mr. Phillips's to about 30 per cent. (1,000 out of 3,500). Other owners have lost equally large numbers. But the amount of injury has not been uniform over the different plantations; Mr. Baber believed that although the weevil was abundant in Sittee River, they had not affected his plantations at Serango Bight or False Sittee at the mouth of the river.

To what this irregular distribution of the attack is due, whether to the varying distance of a cohoon ridge, or to causes affecting the health of the trees, can only be ascertained on the spot. It is noticeable that, according to Mr. Hickey, there are old cocoa-nut groves in Florida the owners of which have had no experience with these borers, and know nothing of them, and the same thing occurs in Asia where the "red beetle" is said to be rare in Penang, and unknown to many planters, though common in Malacca and Singapore.

Now whenever a case of insect injury to trees is investigated, one circumstance is always put forward as a factor in bringing about the infestation: that the trees are in a low state of health. It is constantly disputed, but it turns up so regularly and is so often urged by persons who have only the facts and no previous experience of such economic questions to guide them, that it is impossible to escape from the duty of giving it careful consideration in every case. The present attack is no exception, and the point is raised in the Commissioners' report, to be summarily dismissed. Insects are well known to prefer as a rule an unhealthy plant to one that is sound, and the only questions for consideration are whether any given insect is equally ready to attack trees irrespective of their state of health, and whether any given case of excessive insect injury is traceable in greater or less degree to a previously unsound condition of the host-plants.

V.—FEVER.

The cocoa-nut palms of Honduras appear also to suffer from disease, and disease of an obscure kind not due to insects. It is known as "*fever*," and at present no accurate account has been given of its symptoms, nor of its prevalence, so that it cannot yet be accepted as a cause of the weevils' increase, but it must be taken merely as a hypothesis to be inquired into. From the little known about it, it appears to be allied to one or other of the diseases (if, indeed, they are not the same) observed in Demerara in 1875–6, and in Montego Bay, Jamaica, in 1891. Attention has been called to it in Honduras in a recent communication by Mr. Seay to the Colonial Office, of which the writer has only seen an abstract. According to Mr. Hunter, 50 to 80 per cent. of the trees attacked by the weevil show signs of the disease at the top first. This may be merely a misinterpretation of the early signs of injury due to weevil-grubs before they have been noticed in the trunk, but the statement is of importance and should be confirmed or refuted. In his evidence, Mr. Baber says he "has a small spot on the sea-side in " Serango Bight (very swampy). He there noticed that the trees died off " very rapidly, although of various ages from seven to ten years. Does " not know the cause of death : some trees on better land close by were " not affected" (26). Mr. Schofield states that his plantation was apparently healthy on the 24th December. No tree or plant showed any signs of sickness. The hands went away for the Christmas holidays, and its condition was not observed during the next few days. On the 7th of January he discovered some 15 trees more or less affected, some had actually fallen over, others had their fronds broken and trailing on the ground, while the rest from their yellow and drooping appearance showed plainly that they also were diseased. Commenting on this, he says, "it seems generally thought that it [the weevil] will not " attack a plant unless that plant is in an unhealthy condition. How " then is its presence to be accounted for in trees that only two weeks " ago were perfectly healthy ?" (26)

As it is out of the question to suppose that weevil grubs developed from eggs laid after the 24th of December so as to cause such serious mischief, it is clear that the attack must have started some time before, and that its early stages were overlooked. The fact that no disease was noticed does not go for anything, unless special and thorough examination was made of the health of the trees afterwards found to be attacked, a very different thing from mere non-observance of unsuspected mischief.

The accounts of the disease in Demerara are not of much assistance, because very little light was thrown on the cause. It has been described by the Hon. William Russell, who, in investigating it, was careful to distinguish between it and the work of different species of insects. He says of it that " healthy fine trees in full bear-" ing commence to fail in a few weeks ; all the leaves fall down, and " the centre falls off. No beetle or worm is to be found ; the disease " seems more like what is known as plantain disease "(14). In a pamphlet published at Georgetown and not generally accessible, he gives the following account :—" My first dissection of a tree diseased from blight " led me to suppose that the cause of the disease was the attack of the " weevil in question [presumably the Palm Weevil, though not men-" tioned by name]. The part of the stem immediately under the " cabbage portion was completely riddled by this insect, and hundreds " of grubs, in all stages of development, were found. . . . . On " dissecting the top of the tree, all the fruit germs were found quite " rotten (putrid fermentation), and gave a most offensive smell, and at " the point where the last frond or central spike divides from the " lower fronds, the state of putrefaction was fearful. Fortunately, I " decided upon trying another tree. This time the stem was perfectly " sound, and without a speck ; but on dissecting upwards, and care-" fully removing each frond and its integuments, the outer part was " found to be more or less tainted, and the fruit stalk from which the " fruit had fallen was quite offensive. As the top of the tree was " approached the fruit germs became more and more rotten ; still, on " the integuments of each frond being removed, the cabbage in the centre " was quite sound, so that I could eat the centre to within six inches " of the diseased point, which, when reached, was quite as putrid as " my first specimen. The crimped form of the bottom of this central " spire left no doubt on my mind that the seat of the disease was at " that spot, and that there had been abundance of vitality in the lower " part of the tree to send forth the central shoot until the parts im-" mediately in contact with the putrid matter were poisoned by it. A " careful examination was made of this and various other subjects " without finding a trace of an insect, even with the aid of a powerful " magnifier, and afterwards under the microscope. One small beetle " was found on one subject which is before you, and was named by my " friend, Dr. Whitlock, as *Papalus tridens*. . . . . Seeing that " only one specimen of this diminutive beetle was found in my many " investigations, I can scarcely believe that the disease can be attribut-" able to it "(15). What insect is meant is not clear. The generic name is obviously a misprint for ***Passalus***, but ***Passalus*** (***Eriocnemis***) ***tridens***, Wied. is a native of Malacca, &c. The ***Passali*** lay their eggs in decayed wood, and are harmless. Specimens of the diseased trees, preserved and sent to Kew, were carefully examined by Dr. M. C. Cooke for injurious fungi. His search resulted in the description of several new species, but he could not find one that appeared to be the true cause of the disease. Since 1876 the study of disease-producing fungi has made great strides, and that of bacteria has been almost entirely created ; and it is possible that a similar thorough examination would now yield different results. The treatment then adopted was excision of the diseased parts, washing with clean water, and dressing with caustic lime. No results are given. Mr. Russell was positive that the disease was infectious and spread to windward, and was most virulent where the trees were planted close, three rods each way.

Mr. W. Fawcett, F.L.S., Director of the Botanical Department, Jamaica, has examined into the cocoa-nut palm disease at Montego Bay, Jamaica, and his report in the ***Bulletin*** of the Botanical Department, which it is also advisable to give in full, is as follows :—

" Several trees were cut down, and the roots, stem, leaves, and cabbage examined. There was no evidence whatever of attacks by a beetle ;

there were some small larvæ, some wood lice, earwigs, ants of several species, and other insects on the affected parts, but they were evidently only preying on the diseased juices, and were not the cause of the disease.

"The roots were quite sound, and the stem appeared to be unaffected. Both stem and leaves were of normal size, and there was no indication of a gradual dwindling of vitality due to lack of proper nourishment extending over a long period. The disease, whatever it might be, seemed to be quick in destruction.

"The youngest parts were those affected. The leaves and flowers in the bud were sometimes able, though affected, to withstand the disease so far as to open out, and some leaves and nuts attained almost their full development before the tree succumbed. In the case of tall trees, the first indication of the disease was the dropping of the young fruit. It was stated that the disease in this condition had been checked by setting fire to the fibrous material at the base of the leaves, which process burnt all the leaves; new fronds, however, developed, and the trees were, at any rate for the time, saved. The application of salt to the cabbage had also, it was alleged, been successful.

"In almost all the trees examined the sour smell of a putrefactive fermentation was very noticeable, and I am of the opinion that the disease is due to an organised ferment, which is able to attack the very tender tissues of the youngest parts, even outside the terminal bud. If this ferment can be destroyed by fire or other means before it reaches the terminal bud in the heart of the cabbage, the tree may be saved.

"Any remedy should therefore be applied on the very first signs of disease. If delayed too long until the terminal bud is diseased, the tree cannot be saved.

"Although to fire the fibre at the base of the leaves is easy of application, it is not safe near buildings, and by the destruction of the leaves the production of fruit is for a long time retarded, with consequent loss.

"I would recommend that those who do not care to apply fire should drench the cabbage with a solution of sulphate of iron in water, in the proportion of 2 lbs. of sulphate to 1 gallon of water. A solution of sulphate of copper might also be tried in the proportion of 5 parts to 100 of water and a solution of boracic acid in the proportion of 4 parts to 100 of water.

"All diseased trees which cannot be saved should be cut down and burnt, to prevent infection. In order to give the tree every chance of recovery, the soil might be scraped away from the roots and the ashes of the burnt trees applied, together with some manure.

"It may be said that these remedial experiments are costly, but, on the other hand, the annual value of each tree is stated to be at least 4*s*." (33).

In a later number a correspondent writes:—

"I have not as yet tried the sulphate of iron remedy. I have continued the application of salt and have kept to the firing of the trees, and as far as I can judge at present I consider the last-named remedy good, if the trees are not too far gone when fired. A good number that were fired last year are now bearing fruit. The trees do not recover naturally, and the disease is certainly spreading" (34).

These facts and methods of treatment should be studied by planters in British Honduras; for in the event of disease being proved to occur, suitable steps must be taken to check its increase as well as that of the weevil. But whether the latter is encouraged by the presence of diseased trees or not, no relaxation of the measures taken against it should be permitted.

VI.—OTHER INSECTS.

Another question for consideration is the possibility of other kinds of insects aiding or preceding the weevil in its work of destruction. There is no evidence whatever that such is the case in Honduras, if we except another species of weevil, but it is not so elsewhere.

The Indian weevil shares its responsibility with two other beetles, *Xylotrupes gideon*, Linn., and *Oryctes rhinoceros*, Linn., both quite distinct in appearance and allied to the chafers. The latter, the Rhinoceros, Elephant or "black beetle" of the Indian planter, is a stout cylindrical insect about 2½ inches long; the head has no snout whatever, but is short and broad with small clubbed antennæ, whose ends are formed of several flat plates placed side by side. Between the eyes is a fixed horn, like that of the rhinoceros, large in the male, small in the female. The legs are very strong, with stout shanks set on the outer edge with three teeth, and five-jointed feet.

The grubs are large, soft and curved, *with six stout legs* and a baggy hinder end; they are harmless, and live in heaps of rotting vegetable matter or the manure-like inside of decayed palm trees. The beetles are the destroyers, and attack the palm at night, boring in at the base of the leaf-stalks till they reach the cabbage, thus forming holes which attract the weevils. They bite through the young folded leaves which become characteristically ragged, and may kill the tree by injuring the bud.

Treatment consists in the removal or destruction of the heaps of rotting matter in which they breed, and in extracting the beetles from the holes in the trees with a barbed wire or "beetle spear."

These two insects are not natives of America, but many allied species are there common.

The Hon. W. Russell has described the ravages in Demerara of the Elephant beetle on palms (15). The insect referred to is probably *Megasoma actæon*, Linn., as Dr. Sharp, F.R.S., has kindly informed the writer. A similar species, *Megasoma elephas*, Fabr., occurs in Honduras, and is an enormous insect, some 4½ inches long in the male and 2 inches broad. It is stout and square, black in colour, but densely covered with a fine brown pile. The head in the male is prolonged into a long horn with a forked tip, which is turned up and is not, as in the weevil, a snout with its mouth at the end; there is a shorter horn behind and two on the shoulders. The legs are very stout, and the shanks spined.

The Elephant beetle, according to Mr. Russell, burrows into the earth at the roots of young trees. It makes small holes "like crab holes," and works its way down until the blanched part of the palm is reached, when it feeds on the cabbage, and lays its eggs in the fibrous part, which it teases out. The central spike dies away, and the first sign is a crimped appearance of the fronds. The beetles were got rid of by paying a small sum to labourers to search for them, and by protecting the lower part of the stem with lime, cinders, or rank oil (15).

Other enemies are gregarious caterpillars, scale insects, and a very small white-winged fly, *Aleurodes cocois*, Curtis (8, 11), all of which infest the leaves. For the latter syringing with kerosene emulsion would be the proper means to adopt.

As before stated, none of these have yet been observed in Honduras. The consignment of weevils recently sent to Kew included two examples of a well-known kind, *Rhina barbirostris*, Fabr., which may be called the *Bearded Weevil*. This insect resembles the Palm Weevil in its general plan of structure, but it differs in the following points: It has a straight snout, with the mouth in front of it and not below, the jaws being hooked outwards and distinctly visible. The horns are long, with a slender club, and are inserted in the middle of the snout. The eyes almost meet above, being only separated by a very narrow ridge. The wing cases extend to the tip of the body.

The peculiar and characteristic shape of this insect (Pl. II. 1) will distinguish it without further description. In the male the snout is longer and stouter than in the female, and its anterior half, as well as the breast, is covered with a dense yellow down.

The grub of an allied species, ***Rhina nigra***, Drury, has been figured by Coquerel, who found it abundant in the decayed interior of a screw-pine (***Pandanus utilis***) in Madagascar (10).

The writer knows of no other description of the habits or economy of any species of ***Rhina***. Possibly some of the smaller grubs so frequently found in the stem or the rotting cabbage of decayed palms are those of the Bearded Weevil.

Nothing much is known of causes which check the weevil's increase. It appears to be favoured by an unusually dry season, and is presumably checked to some extent by a wet one. The animals, birds and insects which attack it have yet to be identified. Ants seem to prey on it, and reference to this fact will be found in the next chapter.

Attention is drawn to the following points, as being likely to repay further attentive observations made to determine them :—

1. The spots usually selected for egg-laying in wounded and in sound trees, care being taken not to mistake the work of any other insect for that of the weevil. As oviposition probably takes place at night, it will be worth while to make observations at that time.
2. The length of time passed in each of the different stages, of the number of broods in the year, and of the periods when the majority of the insects emerge, and when they lay eggs. The two latter, as has been shown for the Palmetto Weevil, do not necessarily coincide.
3. The length of time that a felled tree will serve as a source of attraction and a breeding place for beetles, and the earliest symptoms of their presence shown by an infested palm.
4. The relation between the situation of the infested plantations and the cohoon ridges or other districts abounding in wild palms.
5. The preceding state of health of injured trees, with special reference to the character of the soil, drainage &c., and the occurrence of the so-called "fever" or other disease.
6. The species and habits of other insects which may be associated with the Palm Weevil in the work of destruction.
7. The natural checks upon the weevil's increase; the effects of weather ; the presence of insectivorous animals.

It is necessary to distinguish between the sexes in observations on the weevils when egg-laying, or attracted to baits, &c. ; and between their grubs and those of other insects. The females alone are of importance and require to be caught.

VII.—METHODS OF TREATMENT.

To a certain extent, reference has been made to measures adopted against the ravages of the Palm Weevil. It is now necessary to discuss them in detail, and in so doing to keep in mind the ascertained facts of its life-history, and the records of this and similar infestations. These measures will be found, as usual, to fall under two heads, those designed to prevent attack upon trees hitherto untouched, and those intended to save injured plants. The former are more important, for the latter in the opinion of many experienced men do not exist.

1. *Methods of Growth and Cultivation.*

Care should be taken in the choice of sites for new plantations, and special attention paid to the avoidance of undue proximity to a cohoon ridge. Drainage should be thorough, for the trees have been observed to suffer in swampy ground. They should not be planted too close; every occasion of felling a tree in order to thin out a plantation affords a source of attraction to the weevils, and imposes a consequent necessity for destroying the felled trees and stumps that they may not serve as breeding-places. Moreover the spread of any infectious disease is materially assisted by close planting. How far it is expedient or possible to grow the trees in small plantations separated from each other by a belt or intervening plantation of trees, in which wild palms do not occur, the writer does not know, but it is an invariable rule that very large plantations are particularly favourable to the spread and multiplication of any insect that has established itself in them.

2. *Prevention of Egg-laying.*

The trees should be left as far as possible in the natural state, and unnecessary trimming either of fronds or of the fibre avoided. It may be necessary to tie up the older fronds, and if they must be removed the stalk should be cut through sufficiently far from the stem to leave the sheathing base intact. It may be advisable to tar the cut stump if it is found to attract beetles. The value of leaving the trees alone is shown by a passage in Ferguson's *All about the Coco-nut Palm*, which is also quoted by Ridley :—" Scores of instances might be recorded " where, till the trees were come into bearing, a red beetle was never " seen, but, no sooner was the land cleared and the trees trimmed, than " it made its appearance and became very destructive. On one property the trimming system had been carried on for years till, indeed, " more than one-third of the original plants perished, before the estate " was ten years old, and they were going at the rate of three trees " weekly. The work of trimming was stopped for the reasons offered " above; the loss of trees continued for some time afterwards, but at " the end of six months it had entirely ceased. On another property " beetle men had been employed for ten years, and trees were being constantly lost; from the day that the beetlers were discontinued two " trees perished within the month, and not another was lost in the subsequent seven years" (22). And W. B. L. writes in the *Tropical Agriculturist* to the same effect :—" The red-beetle [*Rhynchophorus* " *ferrugineus*] cannot penetrate the leaf imbrication, and, when the " older ones decay in the course of nature, the stem has become too " hard for its operations. A tree here and there may be lost from " an accidental wound or from some defect in the fitting of the leaf " sheaths, but it is only where the good taste of the planter has impelled him to trim the leaves that any serious damage has been done " to a field. All the leaves should be left on the tree till nature disposes of them at her own time and in her own way. Nothing that " can be done to a cocoa-nut tree above ground can be anything but " injurious" (21).

All wounds, whether made by accident or by insects, on the soft part of the stem, leaf sheaths or spike should be at once dressed with a dab of tar mixed with fine sand. Holes should be probed with a "beetle spear" or hooked wire to extract insects which may have caused them, and then plugged with a tuft of fibre or dry grass dipped in tar.

The parts selected for egg-laying on the stem may be plastered with lime-wash, to which, when cold, there may be added, as an experiment, a small quantity of Paris-green (a deadly arsenical poison).

Tarring the stem will probably keep off the beetles, but should be tried with great caution till its effects on the tree have been ascertained. Mr. C. T. Hunter states that he has kept away the beetles by pouring tar on the leaf-spike and the leaf sheaths; he claims for this method that it does not injure the tree and that the effects of it last for some three years. Application of tar to the leaf sheaths would probably do no harm, but may not be necessary if they themselves afford sufficient protection by being left intact. It might, however, lessen any possibility of beetles creeping in to oviposit between loosely fitting sheaths. Such a remedy ought only to be tried on a small number of trees, so that the loss may not be felt if it proves injurious. Most disastrous results have before now followed the application on a large scale of an untested method of treatment to plants. Coatings of moist clay have been found useful in similar circumstances, and a composition which has met with success in Germany is Leinweber's, and is thus prepared: Five pounds of coarse tobacco are infused in a bucket half full of boiling water and allowed to stand for 24 hours. The vessel is then filled with ox-blood and one part of slacked lime and sixteen of fresh cow-dung are added (quantity not stated). These are well mixed and allowed to ferment for two or three days in an open tub, and then applied to the parts requiring protection. It is particularly well suited for the lower parts of the stem.

It is not supposed that the above mixture can be successfully employed in Honduras, but it is given as an example of the class of compositions found to be of service.

Coarse soaps and rank oils (whale oil) have also been of use.

3. *Destruction of Injured Trees.*

This treatment is the one most generally recommended, but it requires caution.

An attacked tree should not be hastily cut before there are unmistakable signs, by the withering of the leaves and spike, that it is doomed. About the possibility of saving injured trees there is much dispute, but a certain number do survive the first attack, especially if low down in the stem, and in India it is found practicable to attempt their cure.

It is useless to cut down any infested tree, unless proper steps are taken to treat it when felled so as to make it unsuitable as a breeding-place. In fact it will be probably less harmful if left standing than if felled and neglected.

To the reckless felling and subsequent neglect of injured trees is to be attributed much of the recent increase in the insects' numbers. On some estates trees have been regularly cut down for several years, and the damage has gone on growing, and it is possible in this way to cut down an entire plantation without getting rid of the beetles. No tree therefore should be cut unless it can be properly handled. When its destruction is decided on it should be either grubbed up or cut off close to the ground; the stump will then serve as a bait to attract weevils, or it may be buried under a heap of earth. On no account should a tree be cut off so high as to leave a tall stump standing.

Perhaps the best way, when practicable, of dealing with felled palms is to sink them under water. Burial in sand has been recommended, and will possibly suffice, but it will not prevent the development of grubs already in the tree, and the subsequent emergence of the weevils, if, as is asserted, they are able to burrow.

Burning is objectionable, because the parts which the grubs inhabit are too soft to burn. Dr. Gabb found healthy larvæ in a tree that had been subjected to burning; and according to Summers, the grubs of the Palmetto Weevil are more partial to the older and more injured plants, particularly to those which have been burnt.

A good method of dealing with felled trees is the following: split them open lengthways so as to expose the soft parts, and extract all grubs or beetles found; visit the trees daily and collect the weevils attracted to them; as the surface dries split them again, so as to expose a fresh moist surface, and continue the capture of beetles and the splitting, till the tree is too dry to prove attractive. When the tree has been thus thoroughly hacked up and dried by degrees it will probably be found to burn easily. As it will take some time for the eggs laid by the weevils which visit them to reach maturity, no fear need be felt about their breeding fresh swarms, provided that they are not allowed to lie too long. Other insects will lay their eggs in the exposed tissues, but their grubs may be neglected, if a look-out is kept against the development in this way of species that are not at present regarded as important. Supposing that it takes six weeks for the weevil to mature, and the period is probably much longer, no eggs laid after the tree is felled will produce beetles if destruction is completed within that time. Of course half-grown grubs overlooked in the tree may mature sooner.

Cohoon and other palms felled in the neighbourhood of cocals ought to be similarly treated, and not allowed to lie and infect the neighbourhood.

4. *Capture of the Weevils.*

This plan has also been generally recommended, and is in some ways preferable to the last. It is attended with no destruction of trees, and is applicable to plantations which have not yet become seriously infested, whereas the felling of palms can only be resorted to when they are already injured.

There are three ways of taking the perfect insects: on the wing or when crawling about; when lurking in the crevices of the leaf-sheaths and fibre; when attracted to baits.

The best way—that by which the greatest number can be caught with the least labour—is the last. It has been mentioned in the preceding section that the stumps and soft tissues—the split cabbage—of felled palms are most suitable for this purpose, because the weevils are attracted in large numbers to the fermenting sap, and can be easily collected. It has been proposed to sprinkle the stumps with Paris-green to kill the weevils visiting them. The experiment may be tried, but will possibly defeat its object, because arsenic is an antiseptic and may check the fermentation of the sap and its attractive odour. The beetles can be collected into buckets and killed with boiling water. If they are apt to escape from the buckets these should be furnished with a tinned iron lid sloping down to a hole in the middle, so as to form a funnel through which the weevils can be dropped.

As the weevil, like many other kinds, seeks shelter by day, the stumps and other baits should be visited at different times, particularly at daybreak, to find out when the insects frequent them most; and the stumps will probably last longer and keep fresher if protected from the sun with a light covering of leaves and fibre, which can be removed to get at the insects.

When no felling of palms is going on, other suitable baits are mangoes or other fruit crushed and allowed to ferment. It has been suggested (32) to cut wild palms in the neighbourhood in order to catch the beetles visiting the stumps. This is open to the objection that these palms must be carefully destroyed, or by becoming breeding places they will be more dangerous than if left standing.

Now the practice of attracting the weevils to fermenting mangoes cannot, however carelessly carried out, increase their numbers.

The search for weevils hiding in the crannies of the palms is more suitable for Indian plantations, where the trees are regularly examined to catch Rhinoceros beetles and the Palm Weevils are taken incidentally. It is simply a question of convenience and the amount of labour involved. Observations may be made to see if there is any hour when the weevils can best be taken on the trees. The females are the important sex, and any means of capture which only takes males will not limit the numbers of the next generation.

One advantage of the method of capture at baits is that it can be carried out by children and unskilled labourers.

Attraction by fires, into which the weevils plunge at night, has been tried in Asia, but the Palmetto Weevil, according to Summers, does not come to light.

5. *Encouragement of Insectivorous Animals.*

Till the habits of the weevils' natural enemies have been more studied, not much can be done in this way, and it is unlikely that there is at present any large destruction of insectivorous birds that requires checking.

Mr. Hunter in the Report (26) ascribed the immunity of his plantations to his keeping a herd of 190 pigs. The practice of letting swine forage is well known and employed in Continental forestry. They are greedy devourers of such large insects and grubs as they can find on the ground or by rooting.

Mr. Craig, another planter, states : " in a group four trees out of 25
" were not attacked, found that those four were infested with black
" ants. Has tried to transplant ants, but failed; says the ants feed on
" the eggs of the beetles.

" Did not understand the various stages of insect life; did not know
" female ants; accidentally smoked some ants out of a tree five years
" old; the next year it was attacked by beetles and died " (26).

The following notes on ants may therefore prove useful :—A colony of ants consists not only of males and females, but of neuter or worker ants. The latter are the forms commonly seen ascending trees, and gathering sticks, grain, insects, &c. Their size is small; and, after the large head, the segments of the thorax are very narrow, and together with the first one or two abdominal segments, resemble a chain of four or five beads joining the head and hind body, which are of nearly equal size; wings are absent. The neuters, of which there are often two kinds, the large-headed "soldiers" and the small-headed workers, cannot reproduce, so that an attempt to colonise them alone must fail. The males and females are much bigger, with a well-developed oval thorax, and a large abdomen which forms the chief mass of the body. They only appear above ground at the "swarming" time and then have long wings. The males soon die, and the females, the larger of the sexes, drop to the ground, lose or tear off their wings, and are placed in nests by the workers, who tend them and their eggs and young. They are no more seen above ground, but can be found by examining the contents of an ant-hill. In temperate countries, at least, they die at the approach of winter, after which the nest only contains workers, and the eggs and grubs of the various forms. Ants have been frequently colonised with success in order to utilise them against other insects. The nest and its contents should be placed in a barrel and transferred to some suitable spot. The disagreeable task can be made more easy by smearing the boots of the labourers, the shafts of the tools used, and the margin of the barrel with grease, oil, or fresh tar. Many tropical species of ants are most injurious, for example, the Parasol ants which cut off and carry away leaves of many trees ; therefore due care must be taken to see that a suitable species is selected for colonisation experiments. In the absence of information as to the particular kind found to be of service, figures of the male and worker of the Parasol ants are given on Plate II. 4*a*, 4*b*, which show sufficiently the differences between these two forms common to other species.

6. *The Cure of Injured Trees.*

This, though little tried in Honduras, has met with a certain amount of success in India.

One method is to cut into the soft parts of the tree, and extract the grubs. This requires great skill, both in observing the early stages of the injury—for it is useless to try it on a tree whose leaf-spike is manifestly dying—and in the operation itself. It is preferable not to attempt to reach the grub, but to kill it by the injection into its burrow of carbolic acid, kerosene, or Paris green suspended in water, but there is a risk of injuring the tree in this way. All wounds should be properly dressed with tar.

Another plan is to apply remedies to the head of the tree, which presumably are carried down to holes made by the grubs at the base of the spike. It is questionable whether these applications are not more of a prevention than a remedy.

An Indian native method of destroying them "is to hang little bags of " salt over the affected parts of the tree. Water is then poured over " the salt, so that the brine soaks into the borings and drives out the " beetle. It is believed that the latter will never return to a tree where " it has been subjected to the above treatment" (35).

The above quotation from a recent report is intended to refer to the Palm-Weevil. It appears, however, to the writer that the plan is used for the Rhinoceros beetle.

Other applications said to have met with success in some persons' hands are slaked lime, kerosene and arsenic ; the latter is perhaps the best, and should be used as Paris green or London purple, stirred up in water in the proportion of about 1 oz. of Paris green and 2 of flour made into a paste, to 10 or 12 gallons of water and sprayed into the head of the tree. If the plant shows signs of injury a weaker solution should be used. Lime deserves a further trial, and nitrate of soda might be used. None of the above methods should be tried on a large scale till they are proved to be harmless to the plant. Firing the head of the tree as recommended for "fever" has also proved a cure, but the palm is greatly weakened, and a further attack is thereby invited. Perhaps the method of pouring poison into the holes is the most promising; according to Mr. Seay it has already met with some success.

The treatment of "fever," or whatever the disease may be, has been already given in the report of Mr. Fawcett (32). For such purposes a solution of sulphate of copper is hardly safe, as it will concentrate by evaporation in the bases of the leaf-sheaths and probably prove injurious; this is true to some extent of any powerful chemicals experimented with, and observations on their effect should be carried out for a long time and not merely for a week or two after application. Sulphate of copper can be much more safely employed in the form of *bouillie bordelaise* made as follows:—

1 lb. copper sulphate (bluestone).
1 lb. freshly burned quicklime.
5 gals. water.

The bluestone should be of good quality, and should be dissolved in water; the lime is slacked and stirred into the solution, which is made up to the proper quantity with water. It should be used fresh, and must be kept stirred, as the copper hydrate formed soon settles. It can be applied with a syringe or spraying pump, and is not to be regarded as an insecticide.

The above list of remedies is intended to include all that have been tried and are likely to be of success under different conditions. The protection of the trees against egg-laying by not trimming them, and the capture of the weevils are, together with the *careful* destruction of killed trees, the most promising.

Concerted action has been generally recommended to planters in respect to the destruction of trees, and in order to secure this ordinances have been proposed but not passed into law, both in British Honduras and the Straits Settlements. The reasons for and against such ordinances are in large measure independent of the soundness of the economic principles on which they are based. It may be desirable to destroy all infested trees, and yet it may be impolitic to enforce the execution of this work by the compulsion of a penal enactment.

Whether the impulse towards efficient treatment of the evil afforded by the interests of the individual is fitly supplanted by the coercion of the State is a question in ethics beyond the scope of the present paper; but it may be asked whether the destruction of injured trees is not likely to be as actively carried out by the co-operation of planters, who are clearly made to understand that it is to their interest and profit to do so, as it will be if they act under the orders of inspectors on whose capacity, tact and vigilance the success of the whole work will depend. For unless the duty of inspection be satisfactorily performed, the destruction will probably be more perfunctory than if the planter is left to his own devices.

Previous attempts to enforce penal enactments of a similar character have sometimes caused undesirable friction, and have resulted in troublesome and costly litigation, and though it may be said that no question of compensation can arise, as the destruction of dying and worthless trees alone is contemplated, this argument assumes the infallibility of the inspectors. A circumstance that may be held to justify such an enactment, namely, the necessity for exercising adequate supervision over small ill-kept native holdings, the owners of which cannot be made to understand the advantage of adopting sound economic methods, is not of importance in British Honduras.

From an economic standpoint alone the proposal to enforce the destruction of infested palms is not entirely satisfactory; for its inevitable effect will be to concentrate attention on that plan of treatment to the neglect of others which, though not less important, are unprovided for in the ordinance. Though the practice is in itself right and proper, it will probably not remove all liability to damage without the assistance of proper cultivation in order to prevent egg-laying, and of the systematic capture of the weevils, neither of which methods can be suitably enforced by penalties, though the latter might, if thought desirable, be assisted by the State. Nothing short of the annihilation of all palms in the districts where cocoa-nut growing is practised will annihilate the weevils without the assistance of other methods, and an ordinance which does not provide for the destruction of the cohoon palms is incomplete. These are cut down by planters, not necessarily interested in cocoa-nut growing, who cannot fitly be included in the clauses of an enactment passed in the interests of another class of the community. If it is necessary to ensure the destruction of felled cohoon palms some other means must be sought.

VIII.—SYSTEMATIC NOTES.

In order to complete this account of the Palm Weevil, it is desirable to give the zoological characters of that species, together with a list of references to other insects mentioned incidentally.

ORDER. COLEOPTERA.

FAMILY. LUCANIDÆ.

PASSALUS (ERIOCNEMIS) TRIDENS, *Perch.*

Wiedemann. Zool. Mag. II. p. 109.
Percheron. *Mon. des Passales*, p. 24, pl. 2, fig. 3.
Castelnau. *Hist. Nat.* II. p. 179.
See also (15, 16).

FAMILY. DYNASTIDÆ.

ORYCTES RHINOCEROS, *Linn.*

Linnæus. *Syst. Nat.* I. 2, p. 544.
Burmeister. *Handb. der Entomologie*, V. p. 199.
Dohrn. *Stett. Ent. Zeit.* XLI. p. 297.
See also (21, 22, 23, 27, 29, 30).

For injury to cocoa-nut trees in Réunion by the larvæ of *Oryctes tarandus*, Ol., and *insularis*, Coq., see Coquerel, *Ann. Soc. Ent. Fr.* (4), tom. VI. p. 334.

XYLOTRUPES GIDEON, *Linn.*

Linnæus. *Syst. Nat.* I. 2, p. 541.
Burmeister. *Handb. der Entomologie*, V. p. 266.
(Larva), De Haan. *Mémoire sur les Métamorphoses des Coléopteres,* in *Nouv. Ann. d. Mus. d'hist. nat.* 1836. IV. p. 115.

MEGASOMA (MEGALOSOMA) ACTÆON, *Linn.*

Linnæus. *Syst. Nat.* I. 2, p. 541.
Burmeister. *Handb.* V. p. 274.
Lucas. *Ann. Soc. Ent. Fr.* (4), tom. x, Bull., p. xli.
See also (15).

MEGASOMA (MEGALOSOMA) ELEPHAS, *Fabr.*

Fabricius. *Syst. Ent.* I. p. 7.
Chevrolat. *Guér. Mag. Zool.* 1843, p. 31, pl. 109, 110.
Girard. *La Nature*, 1886 (1), pp. 55–58.
See also (31).

FAMILY. CALANDRIDÆ.

For the characters of this family of weevils, see—

Lacordaire. *Genera des Coléoptères*, VII. pp. 267–270.
Leconte. *The Rhynchophora of N. America*, pp. 328, 329.

The family is very distinct, and besides many forms of moderate or small size it comprises the largest species of weevils known. They are all inhabitants of tropical or warm temperate countries, and none are indigenous in Britain, though two, *Sitophilus granarius* and *oryzæ*, are often found in granaries, whither they have been imported in corn or rice. The beetles feed almost without exception in various portions of monocotyledonous plants, and, besides the two species mentioned above, others are known to attack sugar cane and maize (*Sphenophorus*), cycads (*Phacecorynus*), bananas (*Sphenophorus*), &c. A list of the food plants of North American species is given in *Insect Life*, I. pp. 198, 199, but the *Cossonidæ* are included in accordance with the views of Leconte.

RHYNCHOPHORUS.

Herbst. *Natursyst. Käf.* VI. 1795, p. 3.
= *Calandra* (pars), Fabricius. *Calendra* (pars), Clairville. *Cordyle* (pars), Thunberg. *Cordylia*, Kirby.
Rhynchophorus, Schönherr, *Gen. Curc.* III. 2, p. 816.
Lacordaire. *Gen. des Col.* VII. p. 275.
Chevrolat. *Ann. Soc. Ent. France* (6), tom. ii. p. 560 *et seq.*

The distinctive character of this genus, which separates it from the other large *Calandridæ*, is the absence of any outwardly projecting lobes on the mandibles, which are furnished with three teeth biting on each other. The snout is strong and curved, stouter in the male, prismatic or crested, and with a brush of hair above the apex. Antennæ inserted at base of rostrum, funiculus six-jointed with joints 5, 6 transverse, club transverse securiform with spongy apex. Thorax flattened, sub-ovate, narrowed at apex with a transverse groove on either side. Elytra striate, abruptly truncate at apex, not covering pygidium. Legs nearly equal in length in both sexes, tibiæ with aspine at apex, third tarsal joint alone cordate, pilose below. Prosternum with a grooved posterior process behind anterior coxæ. Body smoother with fine velvety pubescence.

From this genus Chevrolat (*loc. cit.*) has separated off certain species to form the genera, *Omotemnus*, *Dynamis*, and *Paratasis*. He has not re-characterised the genus *Rhynchophorus* as thus restricted, and has enumerated in it 17 species, of which six belong to the New World. Since his paper four more species have been added from Africa and the Malay region.

The species of *Rhynchophorus* are variable in size, and in some cases in colour. They are therefore difficult to characterise, unless examined in an extensive series, and much work remains to be done in the genus. All of which the habits are known feed upon palms.

R. PALMARUM, *Linn.*

The American Palm-weevil.

Curculio palmarum. Linnæus, *Mus. Lud. Ulr.*, p. 42. 1. Olivier Ent. V. 83, p. 77. 4. Pl. 2, fig. 16, a, b.

Rhynchophorus palmarum. Herbst, *Col.*, VI., p. 5. 1. Pl. 60, fig. I.

Schönherr. *Gen. Curc.*, IV, ii, p. 820.

Calandra palmarum, Fabricius. *Syst. El.*, II., p. 430, 3.

Guilding. *Trans. Soc. Arts*, XLVI, p. 144.

Other references are given by Schönherr (*loc. cit.*).

See also (1, 2, 3, 5, 6, 7, 9, 11, 15, 17, 19, 20, 26, 28, 31, 32).

Deep black, above dull with velvety pubescence; below, shining. Head finely punctured with interocular sulcus; eyes approximate. Thorax flattened, narrowed towards apex, base slightly produced posteriorly, bisinuate on either side, with fine raised margin; finely and diffusely punctured, more strongly at sides and apex, with traces of a median longitudinal elevation. Scutellum large, elongate, produced at apex. Elytra with shoulders prominent, slightly narrowed to near apex with side almost straight, thence more abruptly narrowed, posterior border slightly emarginate; each with six deep striæ and traces of three more at sides, sutural stria not prolonged to base, fourth stria joining posteriorly with fifth, sometimes with sixth and seventh, interstices somewhat convex with feeble diffuse punctuation. Pygidium triangular with central elevation strongly punctured at base and sides, more diffusely in middle, with lateral margin of fuscous setæ. Underside finely punctured, the punctures being close on mesothorax and anterior part of metasternum and metathoracic episterna. Legs stout, set below with fuscous hairs, short on femora, longer on tibiæ; the latter with a long recurved spine at apex; third tarsal joint cordate, with fulvous pubescence.

Thorax and elytra somewhat variable in width.

Male.—Rostrum stout, almost straight, slightly recurved at apex with close confluent punctuation and trace of central keel, apical half set on upper surface with close erect pubescence. Pygidium wider, with trace of apical emargination.

Female.—Rostrum slender, uniformly curved from posterior third to apex, basal punctures weaker and less confluent than in male; setæ on anterior femora very short. Pygidium narrowed and more pointed at apex.

Length, exclusive of rostrum, 14½–20 lines; length of rostrum 5–7 lines.

Habitat.—Central and South America, West Indian Islands.

The British Museum collection contains two *Rhynchophori,* one labelled "Java," the other "Dr. Pearson, Darjeeling," which are indistinguishable from this American species. It is not possible, however, to establish an Asiatic record on the authority of two specimens without more history.

The only description of the *larva* that has any claim to scientific accuracy is that of Guilding (3), and no later one has been published. It has been figured by Merian (1), Herbst (2), Guilding (3), Blanchard (7 and 17). Of these figures the best are those of Guilding and

Blanchard (7). The larva of the allied species *R. cruentatus*, Fabr. (= *Zimmermannii*, Fähr.) has been described and figured by Candèze (12); as well as by Summers (13), and Dr. Horn (18).

There is a rough figure of the larva of *R. ferrugineus*, published by Ridley (30).

Description of Larva.

Stout, fusiform, largest at third or fourth abdominal segment, and diminishing rapidly from sixth posteriorly; with slight ventral curve as far as sixth abdominal segment thence recurved to anal extremity. Head corneous, oval, mouth at lower part; face inclined obliquely forwards, sides uniformly rounded, vertex somewhat flatter; median sagittal (epicranial) suture distinct throughout, bordered behind by a raised margin on either side, thence continued forwards as a fine impressed line dividing at upper third of face to form the lateral branches of the Y suture, which branches (frontal sutures) run to the inferior lateral angles of the face; on either side of the median suture a longitudinal suture running back from upper third of each frontal suture to become lost on occiput, bearing a setigerous pore at its anterior extremity and another midway between frontal suture and neck.

Surface of head above frontal sutures divided by fine furrows into small hexagonal areas, their surface depressed and dull with a slightly raised shining border; five to six bristle pits along either frontal suture and at the side of the head.

Face transversely rugose, with four longitudinal impressions, of which the middle are the deepest, and several bristle pits, one at anterior end of sagittal suture.

An ocellus on either side as a pale spot behind lower extremity of frontal suture, which separates it from the antenna, a small tubercle imbedded on the outer face of an eminence over socket of mandible.

Clypeus transverse, narrowed towards apex, anterior margin feebly incurved, a deep bristle-pore within each superior angle.

Labrum with two deep longitudinal furrows, margin not tri-lobed, closely set with stout curved bristles.

Mandibles short, robust, external surface convex with three deep pits on face, and three prominent condyles at base, inner surface not dentate, apex produced inwards and slightly backwards.

Maxillæ formed each of a conical cardinal piece, excavate on outer margin to receive basilar piece, which is produced on inner side into a lobe set on its elongate anterior face with a row of short bristles, outside apex of lobe a short palpus of two joints, the basal one double as broad as the apical joint; mentum subquadrate, narrowed towards apex, anterior border with a deep V-shaped emargination, surface with two longitudinal impressions, carrying a tri-lobed palpiger, the outer lobes inflated and bearing a palpus similar to that on the maxilla, the inner lobe carrying a rounded ligula with two deep pores on its posterior face: anterior to and connected with labium a thick bi-lobed and densely pubescent lingua.

Head somewhat variable in colour; usually deep pitchy brown, lighter on occiput and along sutures, face very dark, clypeus paler, sometimes testaceous, labrum pitchy; trophi deep pitchy brown, except mentum, cardinal pieces, palpi and ligula which are more or less testaceous. Specimens from sugar-cane in Guiana have the vertex and occiput much paler, sometimes testaceous, with four darker vittæ, two on sides of head, two along sides of sagittal suture.

Body with intersegmental sulci deep on ventral surface, less marked on dorsum, where between them secondary folds extend to sides of body, together with less marked tertiary folds, so that the dorsal surface of most segments forms three transverse ridges ; upper and lateral surfaces with close longitudinal wrinkles, absent over a median impression along vertical surface in which a series of raised pads are marked off by short transverse furrows ; last five abdominal segments with a similar dorsal series.

Pro-thoracic segment divided on dorsum by a transverse fold, its anterior part wide, covered above and at sides by a corneous plate, posterior part forming a small lappet-like ridge and together with dorsum of second and third thoracic segments bearing a number of small irregular corneous patches ; sides of each thoracic segment above ventral impression divided by furrows into three or four well marked corneous tubercles.

Anal segment corneous, produced into a flattened plate set at its edge with four setigerous tubercles, between which the margin is crenate ; above, a deep triangular depression with corneous surface, margined by prominent raised lips, and occupying the dorsum of the pre-anal as well as the anal segment.

Stigmata nine pairs ; the first well-developed, at lower angles of prothoracic shield, the following seven pairs minute, with black margins hidden in inter-segmental folds at anterior part of first seven abdominal segments ; the posterior pair well developed, situated on inner surface of raised margins bounding the triangular depression on dorsum of eighth abdominal segment.

Skin with a yellow velvety pile, worn off on raised callosities of thoracic segments, set at intervals with conspicuous circular bristle pores, arranged in eight longitudinal double rows on sides and ventral surface, less regularly on dorsum, bristles when present small and inconspicuous. Legs absent.

Length, 2½ to 3 inches ; diameter 10 lines.

As the larvæ examined have been preserved in spirit, and thereby discoloured, the colour of the body is not described ; it appears to be a brownish yellow and is so represented in Guilding's excellent picture. Candèze describes nine pairs of stigmata in the larva of *R. cruentatus*, of which the eight abdominal pairs are very minute, and situated at the anterior part of their respective segments, whereas Horn states on the authority of Leconte that in that species abdominal stigmata are completely absent, and that he himself could find no trace of them in a carefully prepared skin. As nine pairs are present in the larva of *R. palmarum*, Leconte and Horn's statement cannot be accepted in place of Candèze's without further examination of the larva of R. *cruentatus.* It is, however, probable that the latter has incorrectly given the position of the posterior pair of stigmata, and that they are placed in both species on the dorsum of the eighth abdominal segment. This displacement of the hind pair has not, to the writer's knowledge, been described in any other terrestrial coleopterous larva (except in *Calandra* (*Phacecorynus*) *Sömmeri*, Burm. (4), in which the anterior abdominal stigmata are not aborted), but it is common in aquatic species. Its importance is obvious in the case of a grub living like the larva of *Rhynchophorus*, in a wet slimy burrow, a circumstance that may account for the almost rudimentary condition of the lateral abdominal stigmata. The posterior spiracles are each connected with a single very large tracheal trunk which runs forward along the side to the head, becoming gradually smaller and being connected anteriorly with the prothoracic stigma. The specimens examined were too decomposed to allow of the connexion with the first seven abdominal stigmata being carefully examined, but the communicating tracheæ are certainly very small. The writer has found that the presence of the posterior stigmata did not escape Guilding's attention. The objects shown as spiracles in some pictures of this larvæ are bristle-pores. Legs are entirely absent, for the most ventral series of thoracic tubercles represents them only in position and is probably not homologous; legs appear in one of Blanchard's plates (17), but the originals are really bristles.

Description of Pupa.

The general features of this are to be seen in the drawing (Pl. I. 3a, 3b). Rostrum extending to the base of the second pair of legs, with two transverse tubercular elevations above base of antennæ, and two small tubercles below; posterior part of prothorax asperate at sides; posterior legs covered by elytra and wings, the former widely separated and ending in a blunt process, the latter almost meeting in the middle line.

Length, 18–20 lines.

The immature insect is brownish black with the following parts brown or testaceous; the apex of the rostrum, the head and antennæ; the anterior border, and some patches at the sides of the thorax; the apex, of the elytra, a band along their margins and two or three bands on disc; the apical half of the tibiæ and the tarsi.

The attacks of *R. palmarum* on sugar-cane have been described by Guilding (3), Schomburgk (11), and Miss Ormerod (19). According to Schomburgk they seldom attack full-grown canes, but only those newly stuck into the ground. Miss Ormerod received specimens from Guiana, and sent them to the British Museum; it was thought that they belonged to two species, neither of which was *R. palmarum.* The writer has examined an imago of that consignment, now in Museum No. II. at Kew, and can discover no difference between it and *R. palmarum*, and the larvæ from sugar-cane agree with those from palms, except in the colour of the head, a minor point.

R. FERRUGINEUS. *Fabr.*

The Asiatic Palm-Weevil; "red-beetle"; "Kandapanuwa."
Calandra ferruginea, Fabricius, *Syst. El.* II. p. 433. 16.
Calandra Schach, id, loc. cit. p. 433. 17.
Rhynchophorus ferrugineus Herbst. *Col.* vi. p. 8. 2. Pl. 60., f. 3.
" " Schönherr. *Gen. Curc.* IV. 2. 827.
" " Chevrolat. *Ann. Soc. Ent. Fr.* (6) tom ii, p. 561.

For other names under which varieties have been described, see Schönherr (*loc. cit.*), or the Catalogue of Gemminger and von Harold. See also (21, 22 23, 24, 27, 29, 30, 35).

R. CRUENTATUS. *Fabr.*

The Palmetto-weevil.
Calandra cruentata. Fabricius.
Rhynchophorus Zimmermannii. Fåhræus in *Schön. Gen. Curc.* VIII. 2. p. 219.
Rhynchophorus cruentatus. Horn, *P. Am. Phil. Soc.* XIII. p. 408 *et seq.*

See also (13, 18, 32).

FAMILY. SIPALIDAE.

RHINA BARBIROSTRIS. Fabr.

Curculio barbirostris.	Fabricius.	*Syst. Ent.* p. 135. 45.
Rhina barbirostris.	Latreille.	*Gen. Crust. et Ins.* II. p. 269. 1.
„ „	Schönherr.	*Gen. Curc.* IV. 2. p. 792.

ORDER. HEMIPTERA—HOMOPTERA.

FAMILY ALEURODIDÆ.

ALEURODES COCOIS. Curt.

J. Curtis (Ruricola). *Gard. Chron.*, 1846, p. 284.
Frauenfeld. Verh. zool. bot. Ges. in Wien. xvii. pp. 793, 801.
Signoret. Ann. Soc. Ent. Fr. (4) tom. viii. pp. 398, 399.
See also (11), pp. 649, 650.

Though the name of this insect has been often referred to in connexion with cocoa-nut diseases, no accurate observations have been made on it since the time of Curtis and Schomburgk. It is clear that it is not a true *Aleurodes*, and according to Signoret the description and figure of its larva given by Curtis suggest affinities with the Scale-insects.

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(34.) 1892. . . . . . Correspondence on the Cocoa-nut Disease. *Bulletin* of the Botanical Department, Jamaica. May.

(35.) 1892. Report of the Superintendent, Botanic Gardens, Bangalore, Mysore, for 1891–2, p. 12.

Note.—In this bibliography are included all important works which describe or figure the early stages of *Rhynchophori*, as well as those giving the details of their life-histories.

W. F. H. Blandford.

London, February 1893.

EXPLANATION OF PLATES.

PLATE I.

THE AMERICAN PALM WEEVIL, *Rhynchophorus palmarum*, Linn.

FIG. 1.—The Perfect Insect:
- *a.* Upper side of male.
- *b.* Under side of male.
- *c.* Head of male.
- *d.* Head of female.

FIG. 2.—The Larva:
- *a.* Lateral view, * prothoracic stigma.
- *b.* Ventral view.
- *c.* Dorsal view of posterior extremity, * posterior abdominal stigma.
- *d.* Anterior view of head, with part of vertex more highly magnified.
- *e.* Inner face of right mandible.
- *f.* Maxillae and labium.

FIG. 3.—The Pupa:
- *a.* Dorsal surface.
- *b.* Ventral surface.

FIG. 4.—The Cocoon.

PLATE II.

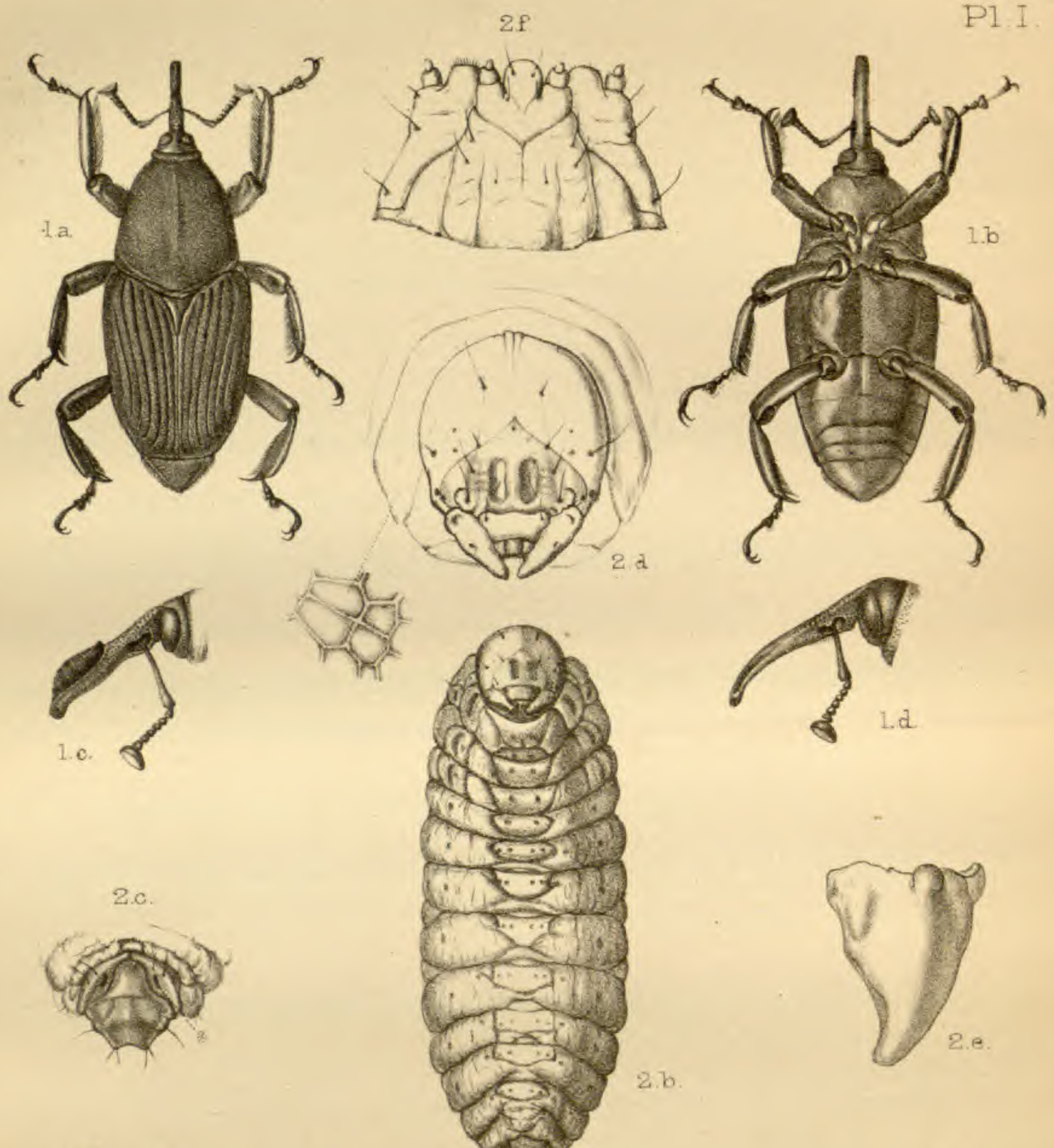
FIG. 1.—The Bearded Weevil, *Rhina barbirostris*, Linn.:
- *a.* The male.
- *b.* The female.

FIG. 2.—*Rhina nigra*, Drury (after Coquerel):
- *a.* The larva.
- *b.* The pupa.

FIG. 3.—The Elephant Beetle, *Megasoma elephas*, Fabr.

FIG. 4.—The Parasol Ant, *Oecodoma mexicana*, Smith (after Packard):
- *a.* The female.
- *b.* The soldier (worker-major).

Pl. I.


2f
1a.
1.b
2.d
1.c.
1.d.
2.c.
2.e.
2.b.
3.a.
3.b.
2.a.
4

R. Morgan del. et lith.

West, Newman imp.

Rhynchophorus palmarum, *Linn.*

Pl. II.

1a.
1b.
2.a.
2.b.
3
4.a.
4.b.

R Morgan del. et lith.

West, Newman imp.

1. Rhina barbirostris, *Fabr.*
2. Rhina nigra, *Drury (after Coquerel.)*
3. Megasoma elephas, *Fabr.*
4. Œcodoma mexicana, *Smith (after Packard.)*

CCXCVI.—NEW ORCHIDS: DECADE 5.

41. **Physosiphon Lindleyi,** *Rolfe;* caulibus foliis brevioribus vel æqualibus, foliis anguste oblongis obtusis undulatis basi attenuatis, scapis foliis longioribus, bracteis spathaceis apice triangulis acutis, perianthii tubo triquetro oblongo lobis reflexis ligulato-oblongis apiculatis tubo æqualibus, petalis obovato-oblongis obtusis, labello trilobo lobis lateralibus erectis subcarnosis rotundatis lobo intermedio suborbiculari-oblongo margine recurvo, columna clavata, clinandrio late marginato.

HAB. Mexico, near Chiapas, *Linden*, n. 1234!

Caules 2 poll. longi v. ultra. *Folia* 2½–3½ poll. longa. *Scapi* 4 poll. longi. *Bracteæ* 2 lin. longæ. *Sepala* 7 lin. longa. *Petala* ½ lin. longa. *Labellum* ¾ lin. longum.

This is the largest-flowered *Physosiphon* known, the flowers measuring fully seven lines in length. A specimen, sent for determination by Mr. F. W. Moore, Glasnevin Botanic Garden, Dublin, in April 1892, without any note of its origin, proves identical with a dried one collected by M. J. Linden, as long ago as 1840, near Chiapas, Mexico. This specimen is wrongly labelled by Lindley, "*Physosiphon carinatum*," a species described by him in 1838 ("Bot. Reg.," xxiv., Misc., p. 72), from a specimen collected by Schiede, near Sosocola, Mexico. Lindley also states that it had been obtained in a live state from Mexico, by Mr. G. Barker, of Birmingham. This statement cannot be confirmed, as the specimen is not preserved in the author's Herbarium. Schiede's specimen is very imperfect, having lost all its flowers, though there are four loose ones in a capsule attached to the sheet. One only has the lip denticulate at the apex, as in Lindley's description and drawing, the others evidently belong to another species, but none of them agree with the one now described. If the flower just mentioned really belongs to Schiede's specimen, *P. carinatum* has flowers scarcely half as large as those of the present species. The lobes of the sepals of *P. Lindleyi* are deep orange-red or brick-red in colour, the tube and the rest of the flower light green. It may be placed next to *P. Loddigesii*, Lindl. Good specimens of *P. carinatum*, Lindl., and *P. emarginatum*, Lindl., would be welcome, as both are very imperfectly known.

42. **Bulbophyllum racemosum,** *Rolfe;* pseudobulbis suborbicularibus compressis monophyllis nitidis, foliis lineari-oblongis subobtusis coriaceis, scapo suberecto laxifloro, bracteis ovato-oblongis apiculatis cucullatis, pedicellis elongatis, sepalo postico elliptico-oblongo obtuso, lateralibus falcato-oblongis subobtusis, petalis ovato-oblongis obtusis, labello recurvo oblongo subobtuso carnoso lævi, columna brevissima alis minutis subulatis falcatis.

HAB. Borneo.

Pseudobulbi 1 poll. longi. *Folia* 4½ poll. longa, 1 poll. lata. *Scapus* 6 poll. longus. *Bracteæ* 3–4 poll. longæ. *Pedicelli* 1–1¼ poll. longi. *Sepalum posticum* 7 lin. longum, 4 lin. latum; *lateralia* 8 lin. longa, 3 lin. lata. *Petala* 4 lin. longa, 2 lin. lata. *Labellum* 2 lin. longum.

This distinct *Bulbophyllum* is nearly allied to *B. anceps*, Rolfe, in "Lindenia," viii., p. 33, t. 351, which is also a native of Borneo. In general habit the two resemble each other, quite as much as they differ from most other known species of the genus, but the present species has much larger flowers than *B. anceps*. They are honey-coloured, the dorsal sepal and the petals spotted with maroon, and the lateral sepals minutely spotted on the upper half, and striped on the lower one with the same colour. The lip is purple, covered with numerous black dots, paler near the tip. The face of the column, also its foot, is spotted with purple on a pale ground. It flowered in the collection of Sir Trevor Lawrence, Bart., of Burford, Dorking, last August, when it was sent to Kew for determination.

43. **Cirrhopetalum brienianum**, *Rolfe;* pseudobulbis ovoideis monophyllis, foliis elliptico-oblongis obtusis coriaceis, scapo suberecto elongato gracili, floribus umbellatis, bracteis subulato-lanceolatis acutis, sepalo postico elliptico-oblongo concavo setifero ciliato, lateralibus connatis elongato-linearibus, petalis suborbicularibus ciliatis, labello recurvo oblongo-lanceolato subobtuso, columna brevissima dentibus minutis.

HAB. Borneo.

Pseudobulbi ½ poll. longi. *Folia* 2¼ poll. longa, ¾ poll. lata. *Scapus* 9 poll. altus. *Bracteæ* 1½–2 lin. longæ. *Sepalum posticum* 2½ lin. longum; *lateralia* 10–11 lin. longa. *Petala* ¾ lin. longa. *Labellum* 1½ lin. longum.

This species was introduced from Borneo by Messrs. Linden, of L'Horticulture Internationale, Brussels, with whom it flowered in March 1891, when it was sent to Kew for determination. A plant from the same source flowered with Mr. James O'Brien, of Harrow-on-the-Hill, in the following October. It belongs to the group having the dorsal sepal and petals ciliate or appendaged, and is allied to *C. makoyanum*, Rchb. f., in "Gard. Chron.," 1879, i., p. 234, next which it may be placed. The lateral sepals are light straw-colour, except a small portion near the base, which, as well as the greater part of the dorsal sepal, petals and lip, is very dark dull maroon.

44. **Cœlogyne borneensis**, *Rolfe;* pseudobulbis aggregatis basi ovoideis apice attenuatis gracilibus diphyllis, foliis obovatis apiculatis subsessilibus trinerviis, scapis erectis, racemis flexuosis multifloris, floribus heterochronicis, bracteis oblongo-lanceolatis subobtusis convolutis imbricatis deciduis, pedicellis gracilibus, sepalis oblongo-lanceolatis acutis concavis, petalis linearibus acutis, labello late elliptico trilobo lobis lateralibus rotundatis obtusis intermedio ovato subobtuso undulato, disco bicarinato, columna arcuata basi gracili apice late alata.

HAB. Borneo.

Racemi 5 poll. longi. *Bracteæ* 1 poll. longæ. *Pedicelli* 7 lin. longi. *Sepala* 7 lin. longa, 2 lin. lata. *Petala* 7 lin. longa, ⅓ lin. lata. *Labellum* 6 lin. longum, 4 lin. latum. *Columna* 5 lin. longa.

This species belongs to Lindley's small section *Flexuosæ*, and may be placed next to the Javan *C. longifolia*, Lindl., which has longer and narrower leaves, and the pseudobulb without a slender attenuated neck. It is a native of Borneo, whence it was introduced by Messrs. Linden, of L'Horticulture Internationale, Brussels, in whose collection it flowered last August. The flowers are whitish or light buff (this point remains doubtful owing to the flowers being somewhat withered), with red-brown reticulations on the side lobes of the lip, and some markings of similar colour on the front lobe. The pseudobulbs and leaves are described from a reduced sketch sent by Messrs. Linden.

45. **Epidendrum laucheanum**, *Rolfe;* caule elongato folioso, foliis lineari-lanceolatis attenuatis acutis, pedunculo terminali elongato compresso arcuato v. apice pendulo multifloro, bracteis lineari-lanceolatis acuminatis, sepalis elliptico-oblongis subacutis v. apiculatis, petalis

angustis oblanceolato-linearibus acutis, labello columnæ adnato cordato obtuso integro subconduplicato apice recurvo, columna clavata.

HAB. New Granada, at Popayan.

Caules circa 8 poll. longi. *Folia* 2½–6½ poll. longa, 3–5 lin. lata. *Pedunculi* ¾–1 ped. longi. *Racemi* 3–8 poll. longi. *Bracteæ* 1–1½ lin. longæ. *Pedicelli* 2 lin. longi. *Sepala* 3–4 lin. longa, 1¼–1½ lin. lata. *Petala* 2–2½ lin. longa, ⅓ lin. lata. *Labellum* 2½–3 lin. longum, 2–2½ lin. latum. *Columna* 1 lin. longa.

A very distinct *Epidendrum* of the section *Spathium*, allied to *E. grandiflorum*, Lindl., but has leaves and flowers not half the size of that species, and the latter far more numerous and produced on a long flattened peduncle. The sepals and petals, as well as the peduncles and rachis, are of a light ochreous brown, or sometimes dull purple-brown, and the lip light glaucous green. It was introduced from Popayan by Messrs. F. Sander & Co., of St. Albans, with whom it flowered in November 1889. It was also received from Mr. F. W. Moore, Glasnevin Botanic Garden, Dublin, in September 1892.

46. **Epidendrum tricolor**, *Rolfe*; caule erecto subcompresso folioso, foliis lineari-oblongis subobtusis, racemis pendulis multifloris, floribus subsecundis, bracteis lanceolatis acutis, sepalis oblongo-lanceolatis acuminatis, petalis filiformibus, labello adnato trilobo lobis lateralibus parvis erectis late rotundatis intermedio elliptico acuto, disco tricarinato, columna clavata.

HAB. Venezuela.

Caulis 5 poll. longus v. ultra. *Folia* 3–4 poll. longa, 6 lin. lata. *Racemi* 4–5 poll. longi. *Bracteæ* ½ lin. longæ. *Pedicelli* 2½ lin. longi. *Sepala* 3–4 lin. longa. *Petala* 3 lin. longa. *Labellum* 2½ lin. longum. *Columna* 1½ lin. longa.

A graceful little species, imported from Venezuela (together with *Cattleya Mossiæ*, Hook.) by Messrs. Hugh Low & Co., of Clapton, with whom it flowered last November. It is closely allied to *E. purum*, Lindl., but is readily distinguished, among other characters, by its orange-coloured lip. The sepals and thread-like petals are light yellow, and the column green. The flowers are small and numerous, and smell remarkably like cucumber.

47. **Stanhopea Lowii**, *Rolfe*; pseudobulbis ovoideis, racemis pendulis bifloris, sepalo postico oblongo subobtuso concavo, lateralibus ovatis subobtusis, petalis elliptico-oblongis subacutis, labello valde carnoso, hypochilio subgloboso ore obcordato-orbiculari lævi prope apicem utrinque obtuse dentato mesochilio crasso integro truncato apice utrinque carinato-alato epichilio triangulo subobtuso convexo, columna arcuata supra medium late alata apice ovato-triangula subobtusa.

HAB. New Granada.

Pseudobulbi 2¼ poll. longi. *Sepalum posticum* 2¾ poll. longum, 1¼ poll. latum; *lateralia* 2½ poll. longa, 1¾ poll. lata. *Petala* 2⅛ poll. longa, 1⅛ poll. lata. *Labellum* 2 poll. longum; hypochilium 1 poll. longum; mesochilium ½ poll. longum; epichilium 5 lin. longum, basi 4 lin. latum. *Columna* 2½ poll. longa.

This handsome *Stanhopea* is allied to *S. eburnea*, Lindl., and *S. reichenbachiana*, Roezl., differing from the former in its globose hypochil and differently-coloured flowers, and from the latter (known only from description) in having the mesochil solid, not deeply channelled, as Reichenbach twice distinctly states in his description. The character is an essential one in the genus, otherwise the distinctness of the present one might be doubted. *S. Lowii* was introduced from New Granada by Messrs. Hugh Low & Co., of Clapton, and flowered in their collection last December. The sepals and petals are of a creamy buff shade, the latter with numerous minute brown spots on the disc. The lip is ivory-white, the upper half of the hypochil with bands of dull maroon, formed of numerous suffused spots with some scattered dots between them. The column is pale green, with ivory-white wings. The flowers exhale a powerful, almost Narcissus-like fragrance.

48. **Aërides platychilum**, ***Rolfe;*** foliis lineari-oblongis obtusis, scapis descendentibus arcuatis multifloris, bracteis latissime triangulo-ovatis subobtusis, sepalo postico elliptico-oblongo obtuso, lateralibus majoribus triangulo-ovatis obtusis ad pedem columnæ adnatis, petalis elliptico-oblongis obtusis, labello plano trilobo lobis lateralibus oblongis obtusis intermedio latissime ovato-oblongo apice breviter bilobo, disci nervis paullo incrassatis, calcare valide reflexo conico obtuso, columna brevi.

HAB. Not recorded.

Folia 6 poll. longa, 1¼ poll. lata. *Scapi* 5 poll. longi. *Bracteæ* 1 lin. longæ. *Pedicelli* 1 poll. longi. *Sepalum posticum* 4–5 lin. longum, 2½ lin. latum; *lateralia* 5 lin. longa, basi 4½ lin. lata. *Petala* 4–5 lin. longa, 2½ lin. lata. *Labellum* 9 lin. longum, 8 lin. latum; *calcar* 3 lin. longum.

This distinct and pretty *Aërides* flowered with Mr. F. W. Moore, Glasnevin Botanic Garden, Dublin, in April 1892, when it was sent to Kew for determination. Nothing is known of its native country. It is allied to *A. houlletianum*, Rchb. f., having similar colours and a very sharply reflexed spur, but the lip is flat, not plicate, and the side lobes are free for less than half their length, not divided nearly to the base and spreading. The sepals and petals are light buff, with a faint purple stain near the tips. The lip is flat or slightly convex, pale yellowish white, the side lobes transversely barred with light purple, the front one with the middle and apex bright purple, and a few similar spots on the sides. The spur is buff-pink. It is an interesting addition to the genus.

49. **Saccolabium mooreanum**, ***Rolfe;*** foliis lineari-oblongis apice brevissime bilobis, scapis descendentibus, racemis densifloris brevibus, floribus parvis, bracteis lineari-lanceolatis acuminatis, sepalis conniventibus elliptico-oblongis obtusis concavis, petalis conniventibus late ellipticis obtusis, labello carnoso trilobo lobis lateralibus semiorbicularibus erectis intermedio triangulo-ovato obtuso concavo, calcare clavato elongato, columna brevi fronte in appendicem decurvum bicuspidatum producta.

HAB. New Guinea.

Folia 4–6 poll. longa, 1½ poll. lata. *Scapi* 5–8 poll. longi. *Racemi* 1–2 poll. longi. *Bracteæ* 1–2 lin. longæ. *Pedicelli* 2–3 lin. longi. *Sepala* et *petala* 2 lin. longa. *Labelli limbus* 1¼–1½ lin. longus; *calcar* 2–3 lin. longum.

A small-flowered *Saccolabium*, introduced from New Guinea (together with *Dendrobium Phalænopsis*) by Messrs. F Sander & Co., of St. Albans, and now represented in several collections. It flowered with Mr. F. W. Moore, Glasnevin Botanic Garden, Dublin, in October last, then with Sir Trevor Lawrence, Bart., of Burford, Dorking, in November, and shortly afterwards with C. J. Lucas, Esq., Warnham Court, Horsham, from all of whom specimens were received for determination. It is allied to *S. Mimus*, Rchb. f., and two or three other Polynesian species, which have a peculiar decurved appendage in front of the column, looking down, as it were, into the spur, as in the genus

Uncifera. The flowers of *S. mooreanum* are densely arranged in a short cylindrical raceme, light rose-colour, each of the segments tipped with green, and the side lobes of the lip and the column white.

50. **Angræcum bistortum**, *Rolfe;* caule scandente radicante, foliis distichis sessilibus lineari-oblongis breviter et inæqualiter bilobis lobis rotundatis, racemis foliis brevioribus paucifloris, bracteis tubuloso-vaginatis apice obliquis subobtusis, floribus secundis, sepalis reflexis ovato-lanceolatis apice subattenuatis subacutis lateralibus subobliquis, petalis paullo angustioribus, labello ovato-lanceolato subacuto, calcare elongato bistorto apice bractea tubulosa includente, columna brevissima, pollinarii glandula lanceolato-lineari pollinis ovoideis stipitibus geminis.

HAB. W. Trop. Africa, Lagos, *Moloney!*

Folia 3–5 poll. longa, ¾–1¼ poll. lata. *Racemi* 2¼ poll. longi. *Bracteæ* 2 lin. longæ. *Pedicelli* 4 lin. longi. *Sepala* et *petala* 4 lin. longa. *Labelli calcar* 9–10 lin. longum.

This species is allied to *Angræcum arcuatum*, Lindl., and *A. chailluanum*, Hook. f., but has considerably smaller flowers, with the additional peculiarity that the spur is curved into a loop, and its tip remains tightly clasped by the sheathing bract; in which respect it appears to differ from every other species in the group. This character, which seems quite constant, gives the spur the appearance of a looper caterpillar. It evidently arises from the unequal growth of the pedicel and spur. When the flowers are quite young these two organs are equal in length, and the tip of the spur is enrolled by the sheathing bract. Then the spur elongates rapidly, but failing to free itself forms a double bend, in allusion to which the name is given. It was collected in the interior of the colony of Lagos, West Africa, by His Excellency Sir Alfred Moloney, K.C.M.G., and was brought to Kew by Mr. J. McNair, late Curator of the Lagos Botanical Station. It flowered at Kew in January 1892.

CCXCVII.—MISCELLANEOUS NOTES.

MR. DANIEL DEWAR, Foreman of the Herbaceous Department in the Royal Gardens, has been appointed Curator of the Botanic Garden at Glasgow.

MR. WALTER IRVING, a member of the gardening staff of the Royal Gardens, has been appointed Foreman (on probation) of the Herbaceous Department in succession to Mr. Dewar.

MR. ROBERT L. HARROW, a Sub-foreman in the Royal Gardens, has been appointed a Foreman at the Royal Botanic Garden at Edinburgh.

MR. GUSTAV HERMANN KRUMBIEGEL, a Sub-foreman in the Royal Gardens, has been appointed Superintendent of the State Gardens under the Government of His Highness the Maharaja Gaekwar of Beroda, in the Bombay Presidency.

MR. FREDERICK ENOS WILLEY, in the employ of the Royal Gardens, has been appointed Acting Curator of the Botanical Station at Aburi, under the Government of the Gold Coast, during the absence on leave of Mr. W. Crowther.

Melhania erythroxylon, Ait.—This is the redwood of St. Helena, an endemic tree 20 feet high, bearing large tubular flowers, white when first expanding, changing in a day or two to pink, and finally to red. It is now almost extinct in the island. In 1883 Mr. Morris, the Assistant Director of Kew, when on a visit to St. Helena brought home seeds of this plant, which were widely distributed. Plants were successfully grown at Jamaica and put out at the Hill Garden attached to the Government Cinchona Plantations. It is doubtful, however, whether any of them have since survived, as the tree is, evidently, difficult to grow under cultivation to a mature state. One of the last of the plants raised from the same seed at Kew was killed during the winter of 1891. It would be interesting to learn whether the tree has been successfully grown elsewhere outside St. Helena. In order to make further trial of it application for a good supply of seed was made a short time ago to Mr. W. Grey Wilson, C.M.G., Governor of St. Helena. This was obligingly sent in November last, and a portion was at once distributed to the following botanical gardens, viz. :—Berlin, Edinburgh, Glasnevin, Paris, Antigua (Leeward Islands), Hakgala (Ceylon), Jamaica, Natal, Port Elizabeth, Sydney, Trinidad, and to T. Hanbury, Esq., at Mentone. The seeds sown at Kew germinated in a few days, and there are now numerous healthy young plants.

Californian Plants.—Kew is indebted to Professor E. L. Greene, of the University of California, for a parcel of about 300 dried plants, from western North America, mostly from California, and largely consisting of types of novelties described by him from time to time. The specimens are excellent, and form a valuable addition to the Herbarium.

Garbelling of Spices.—Probably few persons of the present generation understand what was meant by "garbelling of spices." though the use of the term may still linger in the trade. The sense in which it is used in this connexion is to pick, cleanse, and sort into different qualities. In the gift of books to Kew from Mr. Thos. Hanbury, F.L.S., referred to in the last number of the *Bulletin*, p. 22, is a pamphlet of 87 pages entitled :

A profitable and necessarie Discourse for the meeting with the bad Garbelling of Spices, used in these daies. And against the Combination of the vvorkemen of that office contrarie vnto common good. Composed by diuers Grocers of London, wherein are handled such principall matters as followeth in the Table before the booke. Printed at London, by R. B. for Thomas Man dwelling in Pater noster Row at the signe of the Talbot.

There is no printed date on the title page, but 1592 has been added in manuscript. This is the date given in the British Museum catalogue, and it is also in a measure confirmed by the date 1590 at the foot of a form of "oath we mean to take," p. 61. Apart from the information it contains on the duties and emoluments of a garbeller, this little book is interesting as a record of the various kinds of spice offered for sale at the time. Some have quite fallen out of use, and others are now differently applied or differently spelled; thus, mases (mace), gallingall (*Cyperus longus?*), setwall (zedoary), Moreswax and Stavesacre (seeds of *Delphinium Staphisagria*). However, there was then no established orthography for many of the names, and some of them are very diversely spelled in different parts of this quaint book.

Visitors during the Year 1892. — In the *Kew Bulletin*, 1892, p. 51, a review was given of the number of visitors to the Royal Gardens during the last 50 years. It was shown that there had been a gradual increase of visitors from 9,174 in the year 1841 to 1,373,753 in 1891. The detailed numbers for last year (1892) are as follows :—

Month.	Numbers.	Month.	Numbers.
January - - -	21,583	Brought forward -	682,008
February - - -	20,757	July - - -	201,857
March - - -	44,945	August - - -	244,969
April - - -	179,745	September - -	128,964
May - - -	166,013	October - -	47,164
June - - -	248,965	November - -	30,367
		December - - -	18,828
Carried forward -	682,008		
		Total - -	1,354,157

The total number of visitors for 1892 was 1,354,157. The total for 1891 was 1,373,753. There was, therefore, a slight falling off last year. The total attendance on Sundays was 587,880; on week days 766,277. The greatest monthly attendance (June) was 248,965; the smallest monthly attendance (December) was 18,828. The greatest Sunday attendance (on July 31st) was 34,743; the smallest Sunday attendance (on January 17th) was 980. The greatest week day attendance (on June 6th, Whit Monday), was 82,571; the smallest week day attendance (October 28th) was 146.

Coffee Disease. — A disease of coffee first noticed in Mysore, Southern India, and known as "leaf rot" or "Koleroga," was, described by Dr. M. C. Cooke, under the name of *Pellicularia Koleroga* (see *Kew Report*, 1876, p. 20). A separate report on the subject with coloured illustration was issued by the India Office [April 1876]. The fungus is external in its growth, and covers the leaves with a slimy gelatinous matter. The leaves afterwards turn black and rot at the tips or fall off. The same disease was found by Dr. Ernst on coffee in Venezuela, where it was known as "Candelillo." The identity of the fungus in both localities was fully accepted by the Rev. M. J. Berkeley and Dr. Cooke. The discovery of a parasitic fungus of a very specialised type in coffee plantations both in the Old and New World was regarded at the time as a somewhat remarkable circumstance. The inference was that the disease had possibly been introduced into Mysore from South America. Of late years little has been heard of the disease in either hemispheres. It was at no period so virulent in its character as the well-known coffee-leaf disease of Ceylon (*Hemileia vastatrix*), and with ordinary care on the part of cultivation it was not anticipated it would become a formidable enemy to coffee cultivation. Interest in this disease has now been revived, as it has been found by Mr. T. D. A. Cockerell on coffee in Jamaica, where, however, it was suspected to have existed for some time. Reference is evidently made to it in the following words, which appeared in the *Kew Report*, 1876, p. 20:—" A some-" what similar disease to the *Pellicularia*, but described in too vague a " manner to speak definitely upon, seems to have occurred in 1864 in " Jamaica, the leaves of the coffee plants being covered 'with a white " substance of a gelatinous nature.'" Further, in the *Kew Report*, 1877, p. 27, it is stated, after showing the identity of the "Koleroga" of Mysore with the "Candelillo of Venezuela, that "it is possible that the " disease which I mentioned last year as having occurred in Jamaica " may also be identical with the 'Candelillo.'" In forwarding a specimen to Kew Mr. Cockerell states that the diseased leaves were found on an estate in the neighbourhood of Mandeville. The disease was quite local in its character though abundant in one spot. As it is external in its habit it is needless to add that it may be easily treated in the early stages with powdered lime and sulphur. The fallen leaves should be carefully gathered and burnt at regular intervals. The latter treatment is probably the more convenient to the planter, and if carried out with care and regularity it might be sufficient to keep the disease from spreading to other plantations. The coffee industry in Jamaica is confined to two comparatively small areas, one in the parish of Manchester at an elevation of 1,500 ft. to 2,500 ft., and another in the Blue Mountains at elevations up to 6,000 ft. The best qualities of Jamaica coffee (for which the highest prices reach 135*s.* to 142*s.* per cwt.) are entirely produced in the Blue Mountains district. The occurrence of the present disease in Jamaica coffee suggests that careful steps should be taken to prevent it from spreading and that cultivators should be keenly alive to notice the existence of any disease on their coffee trees, in order that prompt and decisive action may be taken to prevent serious injury.

Grape Rust.—A specimen of grape rust on leaves of the common vine (*Vitis vinifera*) in Jamaica has just been forwarded to Kew by Mr. Theo. D. A. Cockerell, Curator of the Museum of the Institute of Jamaica. Mr. Cockerell describes the fungus in the following extract from *Notes from the Museum*, No. 28:—" On Nov. 8th, I found a num-" ber of grape vines in the vicinity of Kingston severely attacked by a " parasitic fungus. This pest appears on the under-side of the leaves " and looks like an orange-yellow powder, irregularly scattered over the " surface. . . . Specimens of this fungus were sent to Mr. B. T. " Galloway, of the United States Department of Agriculture, who writes " that it is *Uredo Vialæ*, the only rust fungus known to attack the grape." *Uredo Vialæ*, Lagerheim was described from Jamaica specimens obtained at Rockfort (near Kingston) in 1890. The disease had, however, been noticed in Jamaica in 1879, and specimens of leaves were forwarded to Kew and submitted to the late Rev. M. J. Berkeley (*Report Jamaica Bot. Department*, 1880, p. 24). Mr. George Massee has now identified the same fungus as *Uredo vitis*, Thüm., and he has furnished the following note giving the history of its occurrence:—

" *Uredo vitis*, Thümen, Die Pilze des Weinstockes, p. 182, tab. 5, fig. 10 (1878), was described from specimens parasitic on living leaves of *Vitis vinifera* from Aiken, S. Carolina, collected by H. W. Ravenel. Specimens of this fungus were sent to the Rev. M. J. Berkeley in 1879 from Jamaica by Mr. D. Morris, at that time Director of the Botanic Gardens in Jamaica. The fungus now sent by Mr. T. D. A. Cockerell to Kew from Jamaica, and determined by Mr. B. J. Galloway, of the United States Department of Agriculture, to be *Uredo Vialæ*, Lag., proves to be identical with *Uredo vitis*, Thüm., as proved by comparison with a portion of Thümen's type specimen, now in the Kew Herbarium. The type of Lagerheim's species, *Uredo Vialæ*, was collected near Kingston, Jamaica, and is undoubtedly synonymous with *U. vitis*, Thüm., the somewhat imperfect description of the latter having led to the founding of a second species. The aecidial form of the fungus is mixed with the uredo-form in Mr. Morris's specimens." A treatment for this disease in vines might be devised as already recommended in the case of the coffee disease. In the younger stages of the disease it would be found useful to dust the growing leaves, as well as the surface of the soil, at frequent intervals with sulphur, or a mixture of sulphur and lime. When the orange-yellow spores are already developed any remedial treatment then is practically useless. The leaves should, however, be carefully collected and burnt, in order to lessen the danger of the fungus spreading to other plants.

Tropical Agriculture. — An introductory Text Book of Tropical Agriculture has been published by Messrs. Macmillan & Co. from the pen of Dr. H. A. Alford Nicholls, M.D., F.L.S., of Dominica. It is a crown octavo volume of 312 pages, the published price being 6*s.* per copy. This is practically the English edition of a work that obtained the premium of 100*l.* offered by the Government of Jamaica. It was first of all published at the Government Printing Office at Jamaica, and adopted as a text book for the use of the colleges and higher schools in that Colony. It has since been adopted by the Government of other colonies, and it is evident, as stated by the author, " that it has supplied a distinct want." The first part deals with the elementary principles of tropical agriculture connected with a consideration of soils, plant life, climate, manures, rotation of crops, drainage, irrigation, tillage operations, pruning, budding, and grafting. In the second part the application of these principles to the various cultivations undertaken in tropical countries is considered, and useful hints given respecting coffee, cocoa, tea, sugar-cane, fruits, spices, drugs, and food plants. This part appears to be a " record of experience that has been " gained by study, observation, and experimental cultivations " undertaken in many cases by the author himself. The information presented is thoroughly sound and suited to the requirements of " peasant pro-" prietors, the owners of small estates, and to intending settlers in foreign " countries."

Ferns of South Africa.—Mr. T. R. Sim, Curator of the Botanic Garden of King William's Town, has just published a handbook of the Ferns and Fern Allies of South Africa. It contains descriptions of all the species, 179 in number, which are known to occur south of the tropic of

Capricorn, and plates of nearly all of them. Of these 179 species, only 42 are peculiar to the Cape, 75 of the 157 true ferns being found in the south-west district, 78 in the south-east, 89 in Kaffraria, 61 in the Transvaal, and 130 in Natal. The synonymy of the species is carefully worked out, and their distribution traced through the seven geographical districts established by Mr. Bolus. The fern-flora of South Africa does not show the same richness and remarkable individuality which characterises the Phanerogamic botany of the Colony, and continental Africa as a whole is much poorer in ferns and in endemic species than Asia and America. Madagascar, Mauritius, and Bourbon have a very rich fern-flora. Mr. Sim is far behind the time in stating the number of ferns known in Madagascar at 144. The number of species at present known is 366. The per-centage he states for the number of ferns peculiar to Africa (67 per cent.) is far too high. The proper number for the Seychelles is 80, not 30. The book, with its plates, makes all about the Cape ferns so clear, that no doubt it will give a great impulse to the collecting and study of ferns by the inhabitants of the colony.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

Nos. 76–77.] APRIL AND MAY. [1893.

CCXCVIII.—AMERICAN GINSENG.

(*Aralia quinquefolia*, A. Gray.)

WITH PLATE.

In a recent number of the *Kew Bulletin* (1892, p. 107) a note was published on Ginseng, a tonic and stimulant medicine highly valued by the Chinese. It was pointed out that there were two principal sorts of Ginseng known—the North American Ginseng (*Aralia quinquefolia*, A. Gray), collected in the Eastern United States and Canada and exported to China, and the Corean Ginseng (*Aralia quinquefolia* var. *Ginseng*, Reg. et Mack), a principal article of export from Corea into China. The produce of the American plant is used only as a substitute for the Chinese article. It is ranked as about fourth in quality; that from Japan being the least esteemed.

Seeds of the Corean Ginseng were recently received at Kew from Mr. Walter C. Hillier, Her Majesty's Consul General in Corea. It is, however, too early, yet, to give the results. In the meantime, the following information may prove of interest in regard to the American plant, which is proposed to be protected from extinction in Canada by legislative enactment, while in the United States experiments are being carried on to increase the supply by cultivation. The industry, such as it is in the New World, has, hitherto, been entirely dependent on the plants found wild in the forests.

The American Ginseng belongs to the natural order *Araliaceæ*, an order closely allied to the *Umbelliferæ*. Amongst *Araliaceæ* are included plants of very different habits and characters, such as *Panax*, *Fatsia*, the tropical *Sciadophyllum* and *Hedera* (the common ivy). *Aralia quinquefolia*, A. Gray, has a low herbaceous stem seldom more than a foot or 15 inches high, the leaves are longstalked, palmatisect, with usually five leaflets (hence the specific name), arranged in a whorl of three or four at the summit of the stem, the leaflets have generally three larger than the others, they are somewhat thin, obovate-oblong, pointed and serrate. A single umbel of flowers appears on the short, slender, terminal peduncle with small yellowish flowers, the calyx is adherent to the ovary and surmounts it with five minute teeth, the corolla is made up of five small oval white petals which soon fade away, the stamens (when present) are five in number, with small heart-shaped anthers, and there are two, sometimes three, persistent ordinary curved styles.

The ovaries expand into small round bright red berries about the size of small peas each with two seeds. The root (the part used) is tuberous, three or four inches long and usually branching into two or three tap-shaped divisions. It is wrinkled by parallel transverse ridges, and gives rise to a number of fibrous rootlets. The upper portions of the root-tuber show several angular scars, the remains of previous stems which die down annually. As the roots increase with age they often assume strange forms, and such roots are highly prized, the Chinese readily giving large sums for them.

In America the roots are not regarded as possessing active medicinal properties. They have, however, an aromatic bitter-sweet taste, are somewhat mucilaginous, and may have a mild, stimulant, tonic effect.

The spring shoots of Ginseng come out of the ground in New York State about the first of May. "The leaves attain their full " size in June. The blossoms appear about the first of July, and are " very small and delicate. The berries develop rapidly, and are light " green until the 20th August, when they commence to colour; in " September they are bright scarlet, and make a very showy appearance. " The berries are round, elongated, or somewhat triangular in shape, " according to the number in the cluster. They are often as large as a " small pea, and are pleasant to the taste. They fall to the ground " soon after ripening and are covered by the falling leaves."—(*Garden and Forest*, 1892, p. 223.)

An account of the Ginseng plant published by the Department of Agriculture, Canada,* gives the following information: "The plant " has a wide distribution, and is found usually in upland woods and " not in swamps or low-lying districts. It appears to thrive well in " localities where limestone abounds. It frequently occurs gregariously " in beds from which several pounds of roots may sometimes be gathered. " As cattle are fond of the leaves it soon becomes scarce in woods to " which they have ready access. . . . . It was first discovered in Canada, " near Montreal in 1716, by Father Lafitau, a Jesuit missionary among " the Iroquois, and in 1718 a description of it was furnished. The " French soon engaged in collecting and exporting it to China, and so " great did the trade become, that it gave quite an impulse to the " commerce of Montreal for a number of years. At one time great " numbers of Indians were engaged in gathering it about Montreal " and Quebec, and large quantities of it were sent to China. In " 1832 the shipments of Ginseng from the United States amounted to " 407,067 pounds, valued at $99,303. In one county in Wisconsin the " trade is reported to have reached, in 1858, $40,000, and in 1859, $80,000. " Immense quantities have been exported from Minnesota. At present " the chief sources of the plant in the States are Ohio, West Virginia, " and Minnesota. About the close of the eighteenth century it was " discovered also at Massachusetts, its exportation commenced and large " returns obtained. During the last year 75,000 pounds were sent from " America. . . . "

" The quantity sent out of Canada last year [1890] is stated to " represent $100,000, and one retail druggist exported $1,600 worth. " From along the Kingston and Pembroke Railroad fully $20,000 " worth was shipped. The price realised was from $3 to $3·50 per " pound for dry roots. The question is now being considered whether " it would not pay to cultivate it."

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* Ontario Agricultural College. Experiment Station. Bulletin LXV. Ginseng, Toronto, 1891.

In order to prevent the extermination of the Ginseng plant in Canada, the Legislative Assembly of the Province of Ontario has passed a Statute (54 Victoria, 1891) enacting that—

"Except for the purpose of clearing or bringing land into cultivation, no person shall, between the first day of January and the first day of September in any year, cut, root up, gather, or destroy the plant known by the name of ginseng, whenever such plant may be found growing in a wild or uncultivated state."

The penalty for contravening the provisions of this Act is "not less " than five dollars or more than twenty dollars together with the costs " of prosecution, and one-half of such penalty shall be paid to the " prosecutor."

The search for Ginseng roots appears to be as keenly followed in the United States as in Canada. No restrictions have, however, as yet been placed upon digging the wild roots, but it is evident that if the steps taken to cultivate the plant are unsuccessful, its occurrence in the United States in the wild state will become, before long, greatly reduced. Indeed, in an article published in *Garden and Forest*, 1892, p. 223, Mr. G. Stanton, states:—

"From Minnesota to Carolina the gathering [of Ginseng roots] has been carried on until, in the places where this beautiful plant was once so abundant that one could hardly step without treading on it, only single roots can now be found. It is only a question of time when Ginseng at the present rate of destruction will be utterly exterminated from our forests. Last year more of the root was exported to China from this country by 80,000 pounds than was ever sent before in any single year, and notwithstanding the growing scarcity there are 10 persons hunting for the roots now where there was one ten years ago."

Until quite recently there appears to have been a general opinion in America that Ginseng could not be successfully grown as a garden crop. The attempt, it is said, had been repeatedly made "by planting the roots and sowing the seed, but they never grew." Mr. G. Stanton, Summit Station, New York, who may be regarded as the pioneer of the movement to cultivate Ginseng, states:—"My first sowing of seed did not pro- " duce a plant; 200 roots which I put into the ground in 1886 made " little growth the first year, and the outlook was so unfavourable that " I almost abandoned the attempt. In 1887 I put in some roots and " sowed some seeds, and the next year my plants made a better showing. " I then commenced to study the habits and characteristics of the plant, " and with the experience gained my success has been complete. I " had thousands of fine plants growing in my ground in 1891 . . . in " my opinion the growing of the plant can be made profitable, even if " the root does not bring more than two dollars per pound." The price realised in Canada in 1890 for Ginseng, was from three dollars to three dollars 50 cents per pound for dry roots.

In August last the Marquess of Lorne forwarded to Kew an interesting letter received by him from the United States respecting the cultivation of Ginseng. The plant was not at the time in the Kew collections, but application was made for seed, which was received from Mr. Stanton, together with the following letter in regard to the treatment and the general cultivation of the plant:—

Summit Station, New York,
September 3rd, 1892.

In compliance with your request of the 20th August, I send you by mail one ounce (500) Ginseng seed, which I hope will reach you in good condition, and that you may be successful in getting plants from them. You will please keep them in moist earth till they are planted, which should be done as soon as convenient; they must not be allowed to get dry. It takes Ginseng seed 18 months to germinate; planted this autumn, they should send up small 3-leaf plants in the spring of 1894. To obtain best results they should be sown in a bed in the forest, where they could be protected from stock or being trampled upon. A bed three feet wide and four feet long will be ample for one ounce of seed. Ginseng is found mostly in hard-wood forests, upon dry ground, where beech, maple, and basswood predominate.

In garden culture any light, loose, rich soil will meet the requirements, only it must be put in condition that will not bake. The plants must be kept shaded. Meet the natural requirements of the forest as nearly as possible. My methods are to form outlines of beds with boards six inches wide, held in position by stakes; beds three feet wide, any length desired. I sow in drills two to three inches apart, seed one inch apart in drill, put them in about one inch deep, then cover the bed with muck or leaf loam, or some kind of mulching, so as to keep the ground moist. I place brush upon the beds to protect them till the plants come up. When the roots are two or three years old they may be taken up and transplanted, four to six inches apart each way. I have not made much advancement as yet in cultivating from seed, as I have not been in the business long, but I have some fine plants second and first season from seed. In garden culture there is some loss of young plants from snails and insects; worms are also liable to injure the roots. I have placed in one corner of the package 25 last year's seeds, which should give you plants next spring; they were put into the ground one year ago. Those that I have examined look all right. Please examine the germ of one of these with magnifying glass, also one of the fresh seeds. Enclosed you will find four last year's seeds, dry, please examine them also. In package with seed are two fresh berries, one ripe and one green; also a stem from which the berries have been taken; also a stem with three small leaves.

I shall be pleased to hear from you at any time. Should you care to give this matter any further trial I can furnish you with roots next season, providing an order was sent early in August.

A very interesting article on Ginseng, by Nicholas Pike, appeared in the *Scientific American*, January 10, 1891; also by the writer in *Garden and Forest*, May 11, 1892. The Bulletin LXV., Ontario Agricultural College Experimental Station, Toronto, is also of interest.

G. STANTON.

EXPLANATION OF PLATE.

AMERICAN GINSENG (*Aralia quinquefolia*).

[Reproduced from Report of the Botanist, Department of Agriculture, U.S.A., 1884, pl. ix.]

1. Stem with three quinquefoliolate leaves.
2. Sub-globose umbel of flowers.
3. Cluster of berries.
4. Tuberous root branching into two divisions with numerous transverse ridges.

AMERICAN GINSENG (*Aralia quinquefolia*).

CCXCIX.—Y-DZI OF TONQUIN.

(*Coix gigantea*, Roxb.)

In July 1881, there appeared in the *Bulletin de la Société d'Acclimatation* of France a note on the economic value of the Y-dzi, a plant native of Annan, French Cochin-China, and Tonquin. It was described as a grass closely allied to the common Job's tears (*Coix Lachryma*), but believed to be a new species. The name *Coix Ma-yu'en* was suggested for it. The stem was said to attain a height of between 6 and 7 feet. The fruits were smaller than those of the ordinary Job's tears, softer in texture, and not marked with the grey marbling found on the latter. The grains were believed to possess peculiar medicinal properties and to yield a valuable food, either parched, made into a refreshing beverage, or a nutritious soup. In a further note which appeared in the same *Bulletin* for December 1881, a chemical analysis of the grains of Y-dzi was given. There was nothing remarkable indicated in this, and, as will be shown later, it agrees very nearly with analyses of the grains of ordinary *Coix* made in this country. The prominence given to the merits of Y-dzi in France, led to inquiry being made at Kew respecting the advisability of introducing the plant to some of the British Colonies. The impression which the French account produced is very well shown in the following correspondence :—

Mr. E. J. Ackroyd to Royal Gardens, Kew.

29, Oriental Place, Brighton,
1st March 1889.

Dear Sir,

I beg to enclose an extract from a Hong Kong paper, *The Catholic Register*, respecting a shrub called the Y-dzi which is said to grow in Annan and Tonquin.

The article ascribes various valuable properties to this shrub, and I should be much obliged if you would kindly let me know whether it is known at Kew.

Seeing that it could be substituted for the *Eucalyptus*, I was thinking (if that is really the case) of getting some seeds and sending them to Mauritius, where they would prove invaluable if they really destroy miasma.

I hope to return to Hong Kong in October, and, should your report be favourable, I think, through the Rev. Père Limonier, Head of the French Mission, I could obtain some of the seeds. I am spending only a few days here, my permanent address is St. George's Club, Hanover Square, London.

I remain, &c.
(Signed) Edw. J. Ackroyd,
Registrar, Supreme Court,
Hong Kong.

P.S.—If you think it would be worth while, I would bring the matter to the notice of the Government in Hong Kong, and if I obtained some of the seeds I would ask that the plant be cultivated in the Government Botanic Gardens there. I believe I have, through Père Limonier and other persons connected with Tonquin whom I know, facilities of obtaining seeds.

[EXTRACT.]

Our missionaries at Tonquin have sent to the Congregation of Propaganda, in Rome, some seeds of the Y-dzi. This shrub grows six feet and a half high, and could, with far greater advantage, be substituted for the *Eucalyptus*. The Y-dzi is indigenous to Annan, but it is found all over Cochin China and Tonquin. It is also called *bobo* in the Annanite dialect.

The grains of the Y-dzi, stripped of their husk, are eatable like common grains, and possess a peculiar aromatic taste. The Y-dzi is not only a nutritive, but a medicine plant. The inhabitants of Tonquin call it "the grass of life and health," because it destroys the miasma, and purifies unwholesome water. The mountainous regions of Tonquin are extremely unhealthy, especially those lying between Bac Ninh and the Chinese province of Quang Oi. Besides the air, the water of the rivers, which is used there for drinking, is unwholesome as that of wells. Travellers use the Y-dzi in the same manner as tea is used in China. The grains of the Y-dzi, eaten in certain quantities, have been found an efficacious cure of disease of the liver caused by the bad effect of the tropical climate. "The grains of the Y-dzi," writes a missionary of Tonquin, "have excellent properties. They afford a refreshing " beverage which purifies the blood, invigorates the stomach, and is " diuretic. To obtain it they take off the husk, extract the almonds, " and boil them in water. Well-to-do people in Tonking make very " frequent use of the Y-dzi during the summer. Here the plant easily " grows six feet and a half high, and produces a good quantity of " grains. It is sown near pools, marshes, and around gardens, in waste " ground, &c."

MR. E. J. ACKROYD to ROYAL GARDENS, KEW.

Kensington Palace Hotel,
7th September 1892.

DEAR SIR,

IN November or December, 1888, I wrote to you about a tree or shrub in Tonquin called the Y-dzi, said to possess valuable properties for drying up marshy or malarial land, and other purposes.

In reference to this subject I am now able to send you some seeds of this plant, which I have to-day received from the head of the R.C. Mission in Hong Kong. He sends seeds and an extract from a letter written by one of the Missionaries in Tonquin, which says :—

"J'ai trouvé la plante en question, et je vous envoie des graines. Cette plante qui ressemble au Larme de Job demande à être planté dans un terrain frais et près d'un étang, d'une mare. C'est surtout comme refaisant les forces que la graine pilée est prise—on en fait des protages généreux—prise sèche elle garantit de la fièvre dit on."

I am going out to Hong Kong at the end of October, any letters addressed to Mr. Justice Ackroyd, Supreme Court, will always find me. Should you have any news to give me about the seeds or the plant before I leave I will be glad to hear from you, the seeds seem to me to be very dry, do you think there is any use sending some of them to Mauritius ?

Believe me, &c.
(Signed) EDW. J. ACKROYD.

The Director,
Royal Gardens, Kew.

The specimens of seeds of the Y-dzi forwarded by Mr. Justice Ackroyd were duly received at Kew. It was evident that they were derived from a species of *Coix*, and they very closely resembled those of *Coix gigantea*, Roxb., *Fl. Ind.* iii., p. 570. This plant is fully discussed in the *Kew Bulletin*, 1888, pp. 266–268. It is needless to say it is not a shrub, and it possesses no merits for counteracting the malarial influences of marshy localities beyond that possessed by any coarse, quick-growing vegetation necessarily absorbing a large quantity of water. The species of Coix are well-known tropical grasses, found in damp and marshy places. The best known is *Coix Lachryma*, and this is widely distributed in both hemispheres. In many countries it is regarded as a troublesome weed, and a source of annoyance, especially in rice fields. The drop-like fruits known as Job's Tears are used for necklaces and in various ways as articles of ornamentation. The usual colour is white, but they are sometimes found slightly tinged with pink, and sometimes grey or almost black. An account of *Coix Lachryma* var. *stenocarpa* with long cylindrical involucres, used by the Karens (a semi-aboriginal tribe inhabiting certain districts of Lower Burma) for ornamenting their dresses, is given in the *Kew Bulletin*, 1888, p. 144 (with plate).

The peculiar medicinal and nutritive properties attributed to the Y-dzi plant in Tonquin and Cochin China have not been associated before with any species of Coix. The results of chemical analysis of the grains after the removal of the involucre, show only a slight increase in the amount of oil or fat present in the great majority of cereals.

A comparison of the analysis of Y-dzi grains given in the *Bulletin de la Société d'Acclimatation*, December 1881, with that given of *Coix gigantea* in the *Kew Bulletin*, 1888, p. 267, leaves little doubt of the practical identity of their chemical composition, and, for the present, we may assume that the Y-dzi is only a form of the Indian *Coix gigantea*, Roxb., yielding a grain (a kind of pearl barley), long known to yield "an excellent diet drink for hospital patients in China" [Dr. Smith, quoted in "A Classified and Descriptive Catalogue of the Indian Department," *Vienna Exhibition*, 1873, p. 59].

CCC.—MANILA ALOE FIBRE.

(*Agave vivipara*, L.)

This is the commercial name given to a fibre exported from Manila in moderate quantities, but quite distinct in its character and origin from the Manila hemp of commerce. This latter is, as is well known, obtained from a wild banana of the Philippines *Musa textilis* (*Kew Bulletin*, 1887, April, p. 1). The origin of the Aloe fibre was apparently unknown. It was, however, regularly met with in commerce, although the price realised for it was always much below that paid for various sorts of Manila hemp.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

Royal Gardens, Kew,
October 8, 1890.

SIR,

I AM desired by Mr. Thiselton-Dyer to inform you that a sample of "Manila Aloe Fibre" has recently been presented to the Museums of Economic Botany at Kew, and a portion of this sample is enclosed herewith. This Aloe fibre comes regularly into the London market, and is quoted as worth about 14*l.* to 16*l.* per ton.

2. The plant yielding this fibre does not appear to be known in this country. It is evidently quite distinct from *Musa textilis*, yielding ordinary Manila hemp. Probably it is a species of *Agave*, closely allied to that yielding the Sisal hemp of commerce.

3. In order to determine the plant exactly, Mr. Thiselton-Dyer would be glad if the Secretary of State would approve of a reference being made on the subject to Her Majesty's Consul at Manila, with a request that one or two moderately large leaves of the plant be forwarded in a dry box to this establishment. In the case of Agave leaves, it may be mentioned that they travel very well if packed in a perfectly dry state without soil or any other material. If the box is pierced with holes to afford ventilation all the better. It would add to the interest of the specimens if the Consul could add a few words in regard to the methods employed in preparing the fibre.

I have, &c.
(Signed) D. MORRIS.

Sir Villiers Lister, K.C.M.G.,
Foreign Office.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, July 7, 1891.

WITH reference to your letter of the 8th of October last, I am directed by the Marquis of Salisbury to request you to inform Mr. Thiselton-Dyer that Her Majesty's Consul at Manila reports that he has forwarded to Kew Gardens, under the charge of Captain Wilson, of the s.s. "Barden Tower," a small box containing a few leaves of the Manila Aloe plant (Maguay).

The Assistant Director,
Royal Gardens, Kew.

I am, &c.
(Signed) JAMES FERGUSON.

Mr. Consul GOLLAN to ROYAL GARDENS, KEW.

British Consulate, Manila,
May 20, 1891.

SIR,

I BEG to inform you that under directions from the Foreign Office I, this day, forward to you a small box containing four leaves of the Manila Aloe (Maguay), which I trust may arrive in good condition and answer the purpose you have in view. I enclose a few notes from Mr. Osmond, a gentleman who is a considerable expert in such matters, as to the preparation of the fibre.

I send, in the same box, a small specimen of rope of great strength and durability made from another fibre called "Cabo Negro."*

I am, &c.
(Signed) ALEX. GOLLAN,
Her Majesty's Consul.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S.,
Director, Royal Gardens, Kew.

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* The fibre sent as "Cabo Negro" was the produce of the sugar palm of the East Indies, *Arenga saccharifera*.

(Enclosure.)

PREPARATION OF MAGUAY FIBRE.

The leaf is first soaked in water until it becomes quite soft and pulpy, which takes place in about a fortnight. It is then drawn between the thumb and fingers which easily presses off the pulp, leaving a clean fibre. This is afterwards dried in the sun.

If required for immediate use, the leaf is first pared down on each of its flat sides, and afterwards drawn between two pieces of cane lightly pressed together, nothing but the fibres passing through. But this method is a very wasteful one, as many fibres are broken.

Amongst the many uses to which maguay is applied may be mentioned that of violin strings, for which it is much appreciated by the natives.

Manila, May 1891. (Signed) J. H. OSMOND.

The specimens kindly obtained for Kew through the good offices of Mr. Alexander Gollan, Her Majesty's Consul at Manila, were received in good order. They consisted of fresh leaves of an *Agave* in different stages of growth, and there was little difficulty in recognising them as belonging to *Agave vivipara*, L. (A. Cantala, *Roxb.*), the plant which (according to *Kew Bulletin*, 1890, p. 50) yields also Bombay Aloe fibre. The distribution of this plant so far eastward as the Philippine Islands does not appear to have been specially noticed before. It is originally an American plant, and it owes its spread in India, at least, to its use as a hedge plant to keep back cattle. The local name *Maguay*, given to it at Manila, is a generic term applied by Spanish-speaking people to numerous species of Agaves. For instance, in the south of Europe it is often applied to *Agave americana*, although this plant in South America is distinguished as *Maguay de cocuyza*. In some parts of Mexico *Agave vivipara* is known as *Theo-metl*.

The method of preparing the fibre at Manila, described by Mr. Osmond, is very crude, and the result is necessarily unsatisfactory. The process of maceration is not at all well adapted for extracting the fibres from leaves of monocotyledonous plants. The fibres are discoloured by long immersion in water, and during the process of fermentation, extending over a fortnight, the strength of the ultimate fibres is greatly weakened. It may, therefore, be readily understood the value of Manila Aloe fibre is comparatively small, and it can only be profitable to produce it when the price of white-rope fibres is exceptionally high. In the last *Monthly Circular* (dated the 16th March 1893), issued by Messrs. Ide and Christie, of Mark Lane, Manila Aloe Fibre is dismissed with a few words,—" nothing doing, 17*s*." [per cwt.]. In the same circular Bombay Aloe Fibre is described as " dull at 8*s*. to 13*s*." [per cwt.].

CCCI.—BOTANICAL ENTERPRISE IN 1796.

As an interesting instance of the efforts made nearly 100 years ago to improve the circumstances of our Colonial Possessions, it may not be inappropriate to draw attention, in the pages of the *Kew Bulletin*, to a document which treats of the introduction of the clove tree to the island of Dominica and of the reception in this country of probably the first sample of cured cloves that was grown in any British colony in the New World. The publication of this document, at the suggestion of Sir Joseph Banks, with the view of serving as an expeditious mode of communicating information on economic products and plants to distant parts of the Empire almost exactly anticipated the object for which the *Kew Bulletin* was started six years ago. What may very suitably be looked upon as the *Bulletin* of 1796 is entitled "A Narrative of the successful manner of cultivating the Clove Tree "in the Island of Dominica, in the Windward Carribbee Islands. "By William Urban Buée, Esquire. London: Printed in the year "1797." It appears that M. Buée, a Frenchman settled for many years at Dominica, had successfully introduced clove plants from Cayenne to the former island in 1789. Afterwards, in 1791, he bought more trees, 14 in number, from a gardener from Cayenne, whom he met at Martinique. Afterwards these were increased by 1,500 trees raised from seed obtained direct from Cayenne in 1793. The clove trees planted in 1789 "appeared with clove buds on or about the "20th January 1795; some of the cloves were fit to be gathered in "May and June following; and such of the cloves as were left on the "trees for the purpose of obtaining the mother of cloves for seeds "acquired a proper degree of maturity in July and August; so that, "allowing those two trees to be about one year old when they came to "me from the seeds, I think the clove tree becomes productive in the "course of little more than six years."

The close relationship of the clove and the indigenous pimento tree (both belonging to the natural order *Myrtaceæ*) was readily noticed by our author, who deduced the inference that where one flourished the other would also be likely to grow.

Several experiments were undertaken to test the best kind of soils suited for clove cultivation. In one instance the author states, "since "the planting of the last 14 trees it is with satisfaction I can assert "that the four trees planted in clay have grown with at least as "much, if not more, luxuriance than the other ten." Further, "a "pasture ground, formerly in coffee, of a compact, strong, gravelly "soil, with some parts of a clayey nature," was next tried. The result proved that "the trees grew well in both." He concludes, "These [and "other] observations, I hope, will be sufficient to show the nature of the "ground which is fittest for the clove tree, and to prove clearly that it "does not require a rich soil or a loose one; but, on the contrary, will "thrive best in a strong, compact soil, whether of a gravelly or clayey "nature." It will be remembered that in the account of the clove industry at Zanzibar given in *Kew Bulletin* for January last, p. 17, it is stated that the best soil for cloves in that island and Pemba is also clayey. In Dominica our author anticipated that the only drawback to clove cultivation (especially in the district of La Soye, where the soil was suited for little else) was violent winds, as the settlers in that quarter, he says, "had unfortunately and very imprudently cut down all "the woods along the seaside, a thick hedge of which they ought to "have left standing, to prevent the wind from shaking and the sea air "from parching their plants. To remedy this hedges of *poïds doux* "[Inga laurina] may be planted at short distances, particularly towards "the seaside and on elevated grounds facing the east."

As regards yield, Mr. Buée states: "The two trees that have pro- "duced cloves this year, on the Montpellier estate have netted me four "pounds and a half of cured cloves, besides two pounds at least of "cloves which I have left on the trees to obtain mother of cloves, for

" the multiplication of that spice ; and besides this I have about half a " pound of cloves, which having fallen on the ground before their " degree of maturity, have been dried and are very good for domestic " use ; these last are strong but small, so that these two [young] trees " have produced more than seven pounds of cloves." The author then proceeds to describe with great minuteness the manner of " planting and rearing the clove tree from the mother clove." In transplanting for the nursery beds a very ingenious transplanting machine was used, consisting of a tube made of sheet iron with hinges at the side and furnished with two handles at the top. The manner of using this machine was as follows : " Take the planting machine, shut the hinge, lay it over the " plant, taking care the latter is in the centre ; push the machine down " as far as it can go—the deeper the better ; then with a flat trowel dig " into the earth till you have reached the bottom of the planting " machine, and holding it (with the seedling in it), with the left hand " and raising it with the trowel in the right hand, take up the plant and " carry it to the place of its destination." This transplanting machine of one hundred years ago is almost identical with the new and patented machines in use in Ceylon and elsewhere at the present time. M. Buée cured the produce of his clove trees and forwarded a sample to this country in order to obtain the opinion of experts upon the produce. The sample appears to have been forwarded to the Right Hon. Sir Joseph Banks, the President of the Royal Society, to whom later M. Buée's manuscript was also referred by the Earl of Liverpool, afterwards a Secretary of State for the Colonial and War Department. A copy of Sir Joseph Banks's reply is reproduced below. It is an interesting document. It clearly points the way to the policy in regard to botanical enterprise in the colonies which Parliament has committed to the Royal Gardens at Kew, and which has been consistently followed during the last fifty years. It may be added that M. Buée's report was published in this country as recommended by Sir Joseph Banks, and it was illustrated by an excellent double-quarto plate of the clove plant with buds, flowers, and fruit, and a drawing of the transplanting machine.

SIR JOSEPH BANKS to the EARL OF LIVERPOOL.

MY LORD, Soho Square, August 11, 1796.

I BEG leave to acquaint your Lordship that I have read with attention the paper on the successful culture of the clove tree in Dominica, which your Lordship did me the honour of referring to me, and am of opinion that it ought to be printed for the information of His Majesty's subjects in the West Indies and other intertropical colonies.

Mr. Buée is, as far as I know, the first person who has observed that the pimento tree prospers best in those sterile soils where trees whose wood is of a hard texture abound, and that sugar cannot be cultivated to advantage in such places ; also on the other hand, that where trees, whose wood is soft, are naturally found, pimento trees are rarely met with, and sugar plantations will succeed ; on such sterile soils he has tried clove trees, and found them congenial to its nature.

These observations open to the cultivators of hot climates a new source of wealth, which will not probably be confined to the growth of cloves ; other spices may also prosper best in the barren soils of the West Indies, as lavender, thyme, and other aromatic plants are known to do in those of Europe.

I have the honour of sending to your Lordship, with this, a paper containing samples of cloves received by me from Mr. Buée some months ago. Nos. 1 and 2, mentioned by him p. 19, are mixed; No. 3, his best sort, are separate. Your Lordship may, if you think fit, order a comparison to be made, by some dealers in spice, between these and the cloves we usually receive from the Dutch. I shall only add that when I applied for information on the same subject to an eminent wholesale dealer in that article, the only answer I obtained was that he thought me grievously deceived in supposing the cloves to be the produce of the West Indies, he being absolutely certain they came from the East.

In case your Lordship should think fit to order any explanatory matter to be added to Mr. Buée's dissertation, I enclose a list of the useful plants cultivated in the royal gardens at the Isle of France in 1790, and at that time ready for distribution among the colonists. The publication of such a document will not only show the attention paid by the French nation, while under their ancient government, to the transportation of useful plants from one part of the globe to another, but set an example to our Royal Gardens at Saint Vincent's, instituted for similar purposes, though possibly not supplied with equal funds,* and will also encourage the West India planters to apply for and receive such plants, of which there are many, as are now there ready for delivery.

I have, &c.

Earl of Liverpool. (Signed) JOSEPH BANKS.

Mr. THOMAS RUTTON to Mr. WILLIAM FAWKENER.

SIR, Charing Cross, 14th November 1796.

I TAKE the liberty of requesting you to represent to the Right Honourable the Lords of the Committee of Council appointed for the Consideration of all Matters relating to Trade and Foreign Plantations—

That I have individually consulted with several *grocers* on the subject of the cloves [from Dominica], who, upon examining the samples produced by the Lords to Messrs. Bourdillon, Arnaud, Nanson, and Rutton, have uniformly given it as their opinion that they will answer every culinary purpose as well as those of the Spice Islands in the East Indies; and that if the price of cloves could be materially reduced, the consumption might be considerably increased. The samples were not sufficient for the *chymist* or *distiller* to make any experiment.

I am, &c.

Wm. Fawkener, Esq. (Signed) THOMAS RUTTON.

In addition to the clove tree, M. Buée was instrumental in introducing to Dominica "the bread fruit, the cinnamon, the black pepper, and "many sorts of fruit trees from different parts of the world, for several "of which," he says, "I am indebted to Mr. Anderson, of His Majesty's "Botanic Garden at St. Vincent." Of the cinnamon tree he writes in the last paragraph of his report as follows: "Having succeeded in pro-"pagating the cinnamon tree from slips, and from them having now a "great many trees in my possession, this will be the subject of my "future remarks. I will only observe at present that hedges might be "made of that tree to shelter other productions, and by that means "prove a double advantage."

The subsequent history of M. Buée's enterprises at Dominica appears not to have been so satisfactory as they deserved. In Dr. Nicholls's

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* An account of the old Botanic Garden at St. Vincent was given by the Rev. Lansdown Guilding, B.A., F.R.A.S. Glasgow: Richard Griffin & Co., 1825. *See* also *Kew Bulletin*, 1892, pp. 92-104.

Text-Book of Agriculture, lately published in this country, p. 184, the following account is given :—

"The clove, like the nutmeg tree, is a native of the Moluccas, or Spice Islands. . . . . The French succeeded in carrying living plants to Cayenne, and from thence it was brought in the year 1789 to Dominica by a M. Buée, who successfully cultivated the clove and other spices only to be ruined in the end by the operation of the duties imposed on West Indian spices in England, through the jealousy of influential persons who were interested in the trade of the East. Although 100 years have elapsed since the unfortunate M. Buée introduced the spices into Dominica, one of the clove trees planted by him is still alive and flourishing, and the cinnamon bushes have become almost wild, as the seeds are disseminated by birds."

At the present time the clove tree is found in nearly every one of the West Indian Islands, and especially at Jamaica, Trinidad, Grenada, St. Vincent, and Dominica. It is nowhere yet established in regular plantations, and the export of West Indian cloves is comparatively trifling. The largest number of trees is probably found in Grenada, and in that "Spice Island," nutmegs, mace and cloves are exported to the value of about 10,000*l.* to 12,000*l.* Very shortly this value will be considerably increased, as there is extensive planting of spice trees going on, and one proprietor alone has planted about 250 to 300 acres with nutmeg trees, all of which are in excellent condition, and promising heavy crops (*Kew Bulletin*, 1891, p. 147). In Jamaica clove trees would probably flourish on the rich clay lands of the Red Hills, in the parish of St. Andrew, and recently, we notice, the Director of the Botanical Department in that island has issued hints on the treatment of plants which were offered in quantities at the local Botanical Gardens.

CCCII.—CHINESE WHITE WAX.

Chemically this is Cetyl Cerotate. It is defined in Watts's *Dictionary of Chemistry* as "a peculiar waxy substance obtained from " China, where it is produced on certain trees by the puncture of a " species of *Coccus*." Dr. Bretschneider in "Notes on some botanical " questions connected with the Export Trade of China," (1880), remarks, "whilst the insect which produces this wax (*Coccus Pela*) " and its habits have been well studied, the trees on which it is fed are " still imperfectly known."

In 1883 Mr. Field delivered a course of lectures on "Illuminating agents." He stated then that the consumption of insect wax by the Chinese is very large. Little of it apparently finds its way into British trade, "its chief use being to break the grain of spermaceti, the two " crystallisations neutralising each other." A subsequent correspondence with Mr. Field revealed the paucity and uncertainty of our knowledge of the product. Kew accordingly suggested to the Foreign Office that it might be made the subject of inquiry by Her Majesty's Consuls in China.

The five very able reports which are now printed were the result. Their contents have reached the public eye in various forms. If they have not appeared earlier in the pages of the *Bulletin*, it is owing to the extreme pressure on its space. They are now published, if somewhat tardily, in recognition of the pains bestowed upon them by the able officials who prepared them, and also because in this form they will reach the eye of many persons who perhaps would not obtain otherwise the information they contain.

The reports taken together supplement one another, and, as a whole, give an exhaustive account of one of the most curious industries in the world. The tree on which the insect deposits its eggs is undoubtedly *Ligustrum lucidum*, Ait., of this the specimens collected by Scott and Hosie leave no doubt. According to Dr. Henry, in the Province of Hupeh, at Ichang, Nanto, and the mountains to the northward, it is the commonest evergreen tree, from 20 to 30 feet high. According to Hance (Journ. Linn. Soc., xiii., p. 82) *Ligustrum japonicum*, Thunb., Dr. Bretschneider states, "on native authority, is used for rearing the wax insect on." This is an eastern species ; if used at all it is probably only a casual circumstance.

The tree on which the wax is produced is an Ash which has usually been referred to *Fraxinus chinensis*, Roxb. To this Mr. Hemsley, in the *Index Floræ Sinensis*, refers the specimens collected by Cooper, Hosie, and Scott. Roxburgh's species is not, however, wholly free from ambiguity, and M. Franchet, who was consulted on the subject, preferred to refer Hosie's specimens to *Fraxinus rhyncophylla*, Hance. He remarks, however, that the Chinese embrace under one name, Pe-la-shu, all the species of *Fraxinus* capable of supporting the wax insect. Mr. Hemsley finds that the limitation of the Asiatic species of Ash is difficult and uncertain, and he reduces Hance's species to a variety of *F. chinensis*.

The most extraordinary feature in the industry is the process, so graphically described in the reports of transporting the eggs of the *Coccus* from the district where they are produced to that in which the wax is obtained. The *rationale* of this still seems obscure. Mr. Baber states :—"No reproduction of the insect occurs in the Chia-ting plain, " because the twigs of the trees are lopped off and boiled." But it is not obvious why *all* should be boiled, and why nurseries should not be maintained. A statement of Mr. Cooper's may perhaps supply the clue to the explanation :—"The insects owing to their loss of fecundity, have " to be renewed [in Chekiang] every third year, the egg pouches being " imported from the neighbouring province of Fuh Kien."

The industry seems to be a decaying one, and perhaps in a few years will be scarcely remembered, except for the accounts which have been preserved of it. In a Foreign Office Report [1892, No. 1,097] it is stated :—"The export of white wax has shown great decline in recent " years. In 1888 the figures were 15,410 piculs; in 1891, 5,724 " piculs. Its use for giving a hard coating to the soft native tallow " candles seems to be decreasing in the seaports ; foreign candles and " mineral oil having no doubt supplanted to some extent these native " lights. The crop was reported fair, but the price of 35 taels per picul " is very much less than that which it formerly commanded. It was " some years ago priced at 200 taels. Under the circumstances the " bulk of the crop is retained for local use."

A similar industry seems to exist in Japan, though nothing is known as to the details. In the Kew Museums are specimens of Ibota wax obtained from *Ligustrum Ibota*, Sieb., which also occurs in China. This is no doubt an insect wax, the produce of a *Coccus* living on the plant.

(No. 10.) Her Majesty's Consulate, Ningpo,
MY LORD, June 20th, 1884.

ON receipt of Mr. Currie's despatch, dated Foreign Office, February 1st, I at once applied myself towards ascertaining what information regarding the wax insect had been already acquired and recorded by Europeans. I enclose a list of authorities, noting those to which I have obtained access. Having studied these, I paid a visit to the Fathers Rathouis and Hende, of the Jesuit Mission of Siccawei, near Shanghai, and subsequently instituted inquiries as to the localities in this consular district that produced the wax, and under what conditions. Unable, however, to obtain any positive information from the natives whose services I had engaged, I requested and obtained the permission of Her Majesty's Minister to explore the country myself, and more particularly those parts in which I knew that native wax was offered for sale. I have now the honour to report to your Lordship the result of my expedition.

In the Fêng-hua district, whose town is 40 miles from this, I first noticed the ash tree (*Fraxinus chinensis*) growing on the banks of canals at the places where water was being raised for irrigating the paddy fields. The tree is a handsome one, with a straight stem, a shapely head, and abundant foliage. It is planted as a shade for the labourers and cattle. Its height of trunk hinders its coming into general use for this purpose. In the neighbourhood of Ningpo, the Persian lilac, camphor, and tallow trees are preferred. This ash does not thrive on sodden ground. Regarding this ash, the intendant of this circuit, a Yün-nan man, informed me in the course of conversation that in western China the shoots of the ash attain a height of eight feet in a year, and it is from them that abundant wax is formed. It is easily propagated by means of cuttings. I have now in the garden of this consulate shoots of near three feet long from slips given me by Father Rathouis.

I failed, however, to discover during my tour of some 400 miles anything tending to show that the practice exists of placing the pouches of the insect on this tree. On the contrary the nests would appear to be affixed to the large-leaved privet (*Ligustrum lucidum*) only. Of this latter tree (for it is more than a shrub) I noticed on the hill sides two or three groves or plantations.

On my journey, despite the constant inquiries I made, I was unable to find anyone who knew anything of the culture of the wax insect till my arrival at the temple near the summit of the F'ien-t'ai mountain, the head-quarters of Buddhism in the province. There the steward of the monastery told me that the priests yearly gathered the wild wax from the privets that grew in the woods about the hills, but he was not aware that they transferred the insects from one tree to another. It is difficult, he said, to find the insect before the wax be forthcoming. This I can confirm, for on the following day I, with a priest, searched in vain.

On reaching the city of Kiu-hua, near the centre of the province, I inquired at the candle shops—as, indeed, I had done at each town I had previously passed—for this native wax, and at what seemed to me of the largest, found a store of several hundredweight, in the form of broken up cakes. It was, I observed, not so purely white as that imported from Hankow, but I was assured it was unadulterated, and that the dinginess of the colour was due to an admixture of wild wax. The price of this substance is variable. At Kui-hau the average may be taken as 60 dollars for 100 catties, say, some 9*l.* per cwt. The custom at Kiu-hua is to allow 18 taels, instead of the usual 16, to the catty when dealing in it. I purchased a small quantity, 5½ oz., and for this was charged 190 cash, or about, 7¾*d.*

The wax is brought to Kiu-hua from the three districts of Yung-kang, Tung-yang, and Wu-i. It is the product of insects kept on the large-leaved privet. The tree is grown from cuttings, and the plantations are carefully kept clear of undergrowth of any kind in order to prevent the insects straying. The slopes and infertile ground at the foot of hills are preferred for this purpose.

The insects, owing to their loss of fecundity, have to be renewed every third year, the egg pouches being imported from the neighbouring province of Fuh-kien. I could obtain no clue to the cause of their infallibly dying out. These pouches will only bear carriage during the fifteen days of incubation, which appears to be also the only time in which the insects are capable of being transferred.

Insects that escape and are found wild take not only to the holly but two or three other shrubs, as the *Gardenia florida* and *Ligustrum glabrum.* The wax produced on these is not nearly as abundant as that afforded by the insects reared on the large-leaved privet.

The wax producers are preyed upon by a ladybird or beetle resembling that insect and by a hairy caterpillar.

The season for gathering the wax is the middle of the eighth month, which would correspond with the end of September or beginning of October. The deposit is scraped off, the smaller twigs being, however, cut. The twigs so cut and the wax are steamed together, and the resultant strained to clear it from impurities.

The large-leaved privet, which I assume to be the *kan-lah-shu* (dry wax tree) of Mr. A. Wylie, is not known by that name. The *shui-lah-shu* (water wax tree), to which the same gentleman makes reference and which I imagine is the ash, was, I heard, the habitat of an insect that produced yellow wax, but no one knows of its growing in the prefecture. I cannot consider this information to be depended on.

The seeds of the large-leaved privet are used as a tonic in Chinese medicine under the name of *nü-chên-tsz*—nü-chên being the classical (? scientific) name of the plant.

The average supply of late years brought to Kiu-hua for sale approaches 6,000 piculs, or about 360 tons. The value for years has not been apparently effected, except by the variations consequent on the ordinary laws of supply and demand, the latter being more steady than the former.

Before the rebellion the supply was at least threefold. The present facility of transport from Hankow has prevented the industry resuming its former proportions.

The above information was collected from the candlemaker and from an educated man who had resided in Yung-kang. The latter has an orchard in Kiu-hua city, and had introduced the insects into it a few years since. They disappeared, however, in the course of two or three years. The distance of the city from any port, and the necessity of expediting my return, prevented my remaining in the Kiu-hua country with the intent of visiting the sources of production.

The demand for insect wax is principally for the exterior coating of the candles in common use. Though beeswax is abundant and cheap at Kiu-hua, insect wax is found to be more economical for this purpose. The introduction of kerosene, while it has reduced the consumption of rapeseed oil in these parts, has not effected the sale of candles, these being employed for celebrations, such as feasts, religious observances, and the like, and for lanterns, which are carried by every one out after dark.

Another very general purpose for which it is employed is in sizing certain kinds of paper in common use for notes and visiting cards, with the object of giving them a lustrous appearance.

At T'ai-chou-fu an industry is carried on for the manufacture of light articles of Chinese furniture. These are made from the wood of the weeping cypress (*Cupressus Fortunei*). After being smoothed with the dry sheath of a certain rush they are polished with insect wax.

At Amoy years ago many of the inner surfaces of the walls of European houses were coated with shell lime, to which a very smooth surface was given. This was then stained by being washed with some colour, not distemper, and when dry rubbed with insect wax. The walls thus treated stood the climate well, and were found preferable to those lime-washed or oil-painted, as having a brighter appearance, while at the same time they were more cleanly.

Women employ the wax as a fixatrice for their hair, chemists as a component of plaisters and a coating for pills, though for these purposes bleached beeswax is frequently used. I cannot find that here it is applied to wove materials of any kind.

I have preferred retailing the results of my own observation and inquiry, to furnishing the elaborate report that appears called for in Mr. Currie's despatch, as I have not access to much that has been written on the subject, nor have I the leisure or means for spending so much time away from my consular duties in the insect wax country as to fit me to write an exhaustive monograph.

Apart from this, in treating such a subject I need the science of a trained observer to make it worth my own or another's while for me to devote so much time and work as such a task would require; neither can I look to the natives for assistance, as their knowledge of natural history is as limited as their credulity and appetite for the marvellous are unbounded. I trust, however, that the practical information now supplied by me may be found of some value.

I append a list of prices ruling at this port during the last six years, whereby were compiled the quarterly returns of the maritime customs. The tables from which this list is extracted are drawn up with great care by experienced men.

The specimens asked for I am sending direct to Kew Gardens, such of them, that is, as I have been able to collect as yet. I hope in the autumn to obtain twigs coated with the wax and seeds to complete the collection.

I have, &c.
(Signed) Wm. M. Cooper.

Her Majesty's Principal Secretary of State,
for Foreign Affairs.

PRICES of the IMPORTED INSECT WAX at Ningpo during the Years 1878 to 1884.

These prices were obtained by the Foreign Customs for the purpose of estimating the values in their returns. They are given in Hai-kwan Taels per Treaty Picul of 133⅓ lbs.

		Taels.
1878	1st quarter, March 31st	49
	2nd „ June 30th	45
	3rd „ September 30th	48
	4th „ December 31st	44
1879	1st quarter	50
	2nd „	44
	3rd „	44
	4th „	50
1880	1st „	50
	2nd „	52
	3rd „	49·20
	4th „	75
1881	1st „	68
	2nd „	70
	3rd „	56
	4th „	56
1882	1st „	50
	2nd „	60
	3rd „	56
	4th „	54
1883	1st „	50
	2nd „	48
	3rd „	54
	4th „	54
1884	1st „	60
	Average price	Taels 53·45

N.B.—At present, 1 Hai-kuan Tael = 5^{s}_{9} sterling.

LIST OF AUTHORITIES on the WHITE INSECT WAX OF CHINA.

1. Martini's Atlas Sinensis, 1655.
2. Père Gaspar Chauseaune: Memoir published in Panth. lib. III. 830, 1750.
3. *Id.:* Memoir in Lettres Edifiantes, &c., vol. XXIII., pp. 146 seqq. (Paris 1781.)
4. L'Abbé Grosier.
5. Sir George Staunton.
6. Comptes Rendus for 1844. Tome X., page 618.
7. Stanislaus Julien: Industries de l'Empire Chinois, p. 109. Translated from the "Nung Chêng Ch' üan Shu."
8. Dr. Macgowan's paper in the Journal of the Agricultural and Horticultural Society of India, vol. VII., 1850.
9. Pharmaceutical Journal, Feb. 1862.
10. Hanbury: Notes on Chinese Materia Medica, p. 46, 1862.
11. *Id.:* Science Papers, page 60.
12. Roxburgh: Flora Indica, vol. I., p. 148.
13. Wylie: Memoir in Transactions of the North China Branch of the Royal Asiatic Society for 1868.
14. Mesny: Monograph in "N. China Daily News."
15. Richthofen: Letters to the Shanghai Chamber of Commerce, No. VII., of May 1872, page 52.

16. Etude sur le Coccus pé la ; by Père Rathouis, 1880.
17. Hosie : Blue Book, China, No. 2, of 1884.

Of the above, Nos. 1, 2, 3, 7, 8, 9, 10, 12, 13, 15, 16, and 17 have been consulted by me.

REPORT ON THE PRODUCTION OF WHITE WAX IN SSŬ-CH'UAN.

A rush wick in a saucer of oil furnishes the common artificial light of the Chinese ; but in all cases where a lantern has to be illuminated, or a light transported, or a votive offering made to a shrine, a candle becomes desirable. Animal tallow is very little used in Ssŭ-ch'uan, but an excellent substitute is obtained from the seeds of the *Chuan-tzŭ shu* and the *Ch'i shu*, two indigenous trees. The former is the well known tallow tree (*Stillingia sebifera*), the seeds of which are boiled, and the tallow, floating on the surface, is skimmed off. The seeds of the *Ch'i shu*, or Lacquer tree, yield a substance which resembles beeswax in appearance, and is freely used to adulterate that product.

The defect of these vegetable tallows is that they melt at too low a temperature. *Stillingia* tallow begins to run at about 95° Fahrenheit, and Lacquer wax* at some nine or ten degrees higher, and it becomes requisite to procure a harder wax with which to coat candles made from them. For this purpose the famous insect-wax, or white wax, of *Ssŭ-ch'uan*, which melts at about 160° is employed ; an article which has hitherto been the chief source of wealth to the population of the *Chia-ting* plain and the remote valley of *Chien-ch'ang*.

An unlucky accident prevented Baron Ferdinand von Richthofen from reaching *Chien-ch'ang*, but he succeeded in gathering from native informants an account of the wax productions, which, except for one or two unavoidable errors, is accurate enough. To save the trouble of reference and at the same time to explain my text, I quote his remarks :—

"White wax (*Pê-la*). This is a very valuable and very interesting product of *Ssŭ-ch'uan*. It is largely consumed in the country, and much of it is exported to other provinces. The white wax of commerce is made exclusively in the Department of *Chia-ting Fu*, near the western border of the 'Red Basin.' *Ssŭ-ch'uan* people know that it is also made in *Shantung*, *Chêkiang*, and *Fuh-kien*, but speak with contempt of the wax of those provinces. According to my information none is made in *Kwei-chow* and *Yünnan*, or in any of the northern provinces. The department of *Chia-ting Fu* is a region where much level ground spreads between gentle hills, and bears, therefore, an exceptional character in a country so uniformly hilly as *Ssŭ-ch'uan*. Its climate is warmer than that of the plain of *Ch'êng-tu Fu* but not so warm† as that of the valley of *Ning-yuan Fu*, which is better known as the region of *Chien-ch'ang* and highly reputed for the beauty of its scenery. With admirable sagacity the Chinese have found that the breeding of this wax insect, and the production of the wax through it, are two distinct processes which cannot be combined profitably in one and the same locality, but if judiciously separated may lead to unexpected perfection.

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* The Lacquer wax is, of course, entirely distinct from the lacquer or varnish obtained from the same tree by incision of its trunk.

† The Baron is not, of course responsible for the opinion that *Chien-ch'ang* is warmer than the *Chia-ting* plain. In my experience it is 12 or 15 Fahrenheit degrees colder ; being some 3,000 feet higher in level.

"The regions of *Chien-ch'ang* and of *Chia-ting Fu* divide the labours and the profits. In *Chien-ch'ang*, near the cities of *Ning-yuan Fu* and *Hui-li Chow*, the insect tree is planted, an evergreen tree with large and pointed ovate leaves. It is so valuable that it constitutes a separate article of property, distinct from the soil on which it grows. On this tree the wax insect lives and breeds, but secretes little wax. It is evidently under conditions best fitted for its healthy development. The wax which is made in *Chien-ch'ang* is just sufficient for the small local consumption and the supply of *Yünnan*. At the end of April the *Chien-ch'ang* people leave their country in great numbers, each with a load of the precious eggs on his back, and travel on a very mountainous road to *Chia-ting Fu*, which they reach after a fortnight's arduous walking. The road is said to present then a very lively aspect, chiefly at night time, when they go with lanterns. The heat of the day must be avoided, because the sun would quickly hatch the eggs. These are described as a substance resembling flour, and contained in a bag of the size and shape of a pea. Three hundred of the little bags weigh one *Tael*. They are eagerly bought up in *Chia-ting Fu*, and immediately put upon the wax-tree. This tree is said to produce no seeds in *Chia-ting Fu*, and to be easily multiplied by cuttings. It is not allowed to grow freely, but is kept short as a stump six or seven feet high. The shoots grow very rapidly. In the following year they serve for harbouring the insect, and, as they must then be cut off, other twigs are allowed to grow in the third year. In the fourth wax is again made, and so on alternately from year to year. When the egg-balls are procured they are folded up six or seven together in a bag of palm-leaf. These bags are suspended on the twigs of the trees. This is all the human labour required. After a few days the insects commence coming out. They spread as a brownish film over the twigs, but do not touch the leaves. The Chinese describe them as having neither shape, nor head, nor eyes, nor feet. It is known that the insect is a species of *Coccus*. Gradually, while the insect is growing, the surface of the twigs becomes encrusted with a white substance; this is the wax. No care whatever is required. The insect has no enemy, and is not even touched by ants. In the latter half of August the twigs are cut off and boiled in water, when the wax rises to the surface. It is then melted and poured into deep pans. It cools down to a translucent and highly crystalline substance. Ten *Taels*' weight of eggs produces from two to three catties of wax."

"The insect produces no eggs in *Chia-ting Fu*. The natives believe that the climate is not warm enough. It appears, however, that the plentiful secretion of wax indicates a sort of diseased state, owing, perhaps, to a too luxurious food. Where the insect breeds, the secretion is much less, and the wax is of an inferior description. The wax trees are planted in fields, either on level ground or on the lowest portions of the slopes of hills. They are very plentiful in the districts of *Omi*, *Chia-chiang*, *Hung-ya*, and *Lo-shan*, all of *Chia-ting Fu*. Every attempt to produce good wax in other regions has failed."

Such is the Baron's account. Since his report was published in the well known "Letters to the Shanghai Chamber of Commerce," I have visited all the places mentioned above, and in the summer of 1887 I traversed the whole length of *Chien-ch'ang*. Its northern boundary is the Fung, or *Ta-tu*, River in *lat*. 29° 20′, and it extends southwards to *Chin-ch'üan* Bridge in *lat*. 27° 11′. It is not until the town of *Lu-ku*, in *lat*. 28° 13′, is reached, that the valley becomes level and populous; north of that point a maze of passes and deep ravines seriously obstructs both cultivation and traffic, and affords every convenience to the border tribes for attacking convoys and caravans. The comparatively level part of *Chien-ch'ang*, through which the *An-ning* river runs, is the centre of the egg culture, but there are besides many outlying spots in which it is successfully conducted.

The general opinion of the Chinese that wax cannot be produced in the districts where the insect is propagated, and conversely that reproduction does not take place in regions which are favourable to the deposit of wax, has led Europeans to suppose that the plentiful excretion results from a diseased state of the insect, brought about by its transportation to an uncongenial climate. But I soon found that the alleged incompatibility of wax-making with breeding is accounted for in a much simpler way. No large deposit of wax takes place in *Chien-ch'ang*, because the eggs are carried away to other districts. No reproduction of the insect occurs in the *Chia-ting* plain, because the twigs of the trees are lopped off and boiled. It is clear that you cannot have wax if you exile the insects, and that you cannot have insects if you boil them down. But in *Chien-wei-Hsien*, on the *Min* river, where the conditions of climate, soil, and situation resemble those of the neighbouring wax-district of *Chia-ting*, both insects and wax are produced, separately, with perfect success; as is also the case in the *Fu-lin* valley, immediately south of *Ch'ing-ch'i Hsien*, where the conditions are much the same as in the egg district of *Chien-ch'ang*.

I have twice visited the *Fu-lin* valley, into which the wax production has only lately been introduced (in 1874 or 1875), and as the natives are very willing to give information about their new industry, I easily acquired a plentiful stock of fact and fiction. My second visit was in May 1878, when the eggs had just been placed on the trees. The eggs are contained in a spherical gall of a dark brown colour, a quarter of an inch to three-eighths in diameter, which is thin, hard, and brittle in substance, but becomes softer and slightly flexible when wet. There is a more or less circular opening or breach at the point where the gall* was detached from the tree on which it was originally formed. Of such galls I opened 40 or more, and found the less mature full of a white powder resembling wheat-flour, but coarser, which acquires a yellow tinge as the time approaches for the birth of the insects. Each grain of this is an egg. In most of the galls which I examined the eggs were nearly all hatched, and the brood was actively crawling out through the circular breach. Every gall must certainly yield, on a moderate estimate, more than a thousand insects, for when these first march out into the world they are so exceedingly small that the unassisted eye can hardly detect individuals except under favourable conditions of light and colour. Close and sustained scrutiny with a strong magnifying glass shows that they have six legs and a pair of antennæ, and that they are of two kinds, white and red, which it may be assumed are the two sexes. The white are reported to grow larger than the red, ultimately reaching the size of a Sesamum grain. I suppose the red kind to be the female. What appears to be her alimentary canal is perceptible through her back, but the male is more opaque.

The natives affirm that one reason why the egg-galls must be carried with all speed to the wax country is to forestall the ravages of the "*wax-dog*," a parasite which, in their opinion, is formed in the gall along with the nascent insects, and soon devours them unless they are forthwith put to the trees. I was very eager to discover this insect cuckoo, but I found a specimen without any search in the first gall I examined—a white, oval, phlegmatic, obese, waxy, legless grub, about a hundred times as big as its victims, a terrible parasite indeed. It is called the *wax-dog* on account of its supposed voracity, and sometimes the "*wax buffalo*" from its comparatively gigantic size. It lies in a bed of greasy fluff, encompassed by its prey. The second gall I opened also contained a buffalo; and so did the third, and so did the fourth, and so did every one I examined which contained anything at all. I had counted somewhere into the twenties, when in a gall of not more than average size came suddenly upon no less than six of these greasy monsters all ensconced together.

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* "Gall" is an inaccurate term in this application, but it serves the purpose of description.

Insect life under such conditions seems scarcely worth having, if, that is to say, one's sympathies are on the side of the devoured. But by this time I had collected a whole herd of buffaloes, and, on comparing them, the backs of some seemed to be breaking out into ridges and plates, as if under a phase of transformation. It should be remembered that the galls which I was examining were in different stages of maturity, some being perhaps five or six days more advanced than others; the contents of some were barely hatched, while a few were mere empty withered husks; and in one of the latter I found to my exceeding surprise and excitement, a jet black muscular beetle, which sprang actively from the husk, lifted its elytra, unpacked its wings, and flew solemnly down the breeze before I could secure it.

Very possibly, therefore, the natives are right in supposing the buffalo to be an interloper; and yet I was for a long time persuaded that this waxy grub is the mother of the brood, and even now I am reluctant to abandon the belief. But according to all analogy the Coccus-mother ought to die some time before the young are hatched, and dry up into a mummy attached to the inside of the gall, which is a kind of carapace. Moreover, how is it possible to account for six mothers under the same roof? In any case it seems difficult to explain the presence of the beetle. He was much too large to have crept in through the breach, and apparently much too mature to have been developed inside in so short a time.

Such speculations and inquiries must be left to the professional entomologist. It is time to return to our red and white insects. The mother-gall being placed upon a suitable tree, the young brood march out at a good round pace and ascend the branches, the red females leading the way; after a period of desultory wandering they reach the leaves, on which they seem to feed, but the quantity they consume is imperceptible, and the leaves remain to all appearance uninjured. In about ten days they return to the thin upper twigs, where, according to the natives, the males begin to excrete wax, and the females to form the galls either amid the wax or apart from it. The deposit of wax gradually increases until a hundred days from the date when the galls were attached to the tree, and the twigs are then almost entirely coated with a layer one-third of an inch or less in thickness. The whole process extends from the middle of May to the end of August. While still on the tree, the deposit is a kind of dense greasy fluff, and looks very much like sulphate of quinine. The twigs, with their coating, are cut into convenient lengths and put into a pot with a little water. After boiling point has been reached the fire is removed, and when ebullition ceases the poorer quality of wax, with the hard parts of the insects and other impurities, sinks to the bottom. The clear wax is skimmed from the surface and poured into a mould, where it solidifies into the wax-cakes of commerce; the residue is turned into a bag through which it is squeezed, and yields an inferior quality.

The wax must be gathered in due season, for in the natural order of things the male ultimately extricates himself from the deposit and makes off. If they are allowed to escape, seven-eighths of the wax, I was told, would be lost.

The gall first appears as a small wart or barnacle on the bark, and gradually swells until February, when it has become a globe adhering to the bark by the lip of a circular orifice. The smaller the orifice the more productive, it is said, the eggs are likely to prove. At this stage the galls contain only a milky liquid; the floury eggs begin to form in March, and the so-called buffalo appears contemporaneously. In the *Fu-lin* valley, where, as I have said, most of these facts and opinions were gathered, the galls are broken from the tree during the floury stage, and being folded up a dozen or so together in a broad leaf, usually that of the *Fung-tzu* (*Elæocarpus*), are tied to a branch of a neighbouring tree. But nearly all the galls grown in *Chien-ch'ang* are conveyed to *Chia-ting* plain, a few only being retained for purposes of reproduction. It is of course impossible to carry them while the contents are liquid ; the milk would run out at the hole. Unluckily for carriers the interval between the milky and the hatching stage is short, and the young insects are just as prone to run out as the milk. Hence the journey has to be made with all possible despatch ; the carriers cannot march while the sun is high, for the heat would hatch the eggs. The stages must therefore be made by night, and everyone must carry a lantern. It is also apparent that the whole body must set out within the same day or two, and since their average number is about fifteen thousand, all hastening by the light of their lanterns over some of the wildest passes and plateaux in the world, each eager to outstrip his fellow and get first to ferry or hostel, it will be easily imagined that their march is like the headlong flight of an army. The *Fung* river is more generally known in western *Ssŭ-ch'uan* as the *Ta-tu*, or "Great Ferry," river, from its crossing by the egg-carriers near *Tu-lin*. The spectacle of its passage during the egg season, as the ferrymen told us, "is more exciting than the slaughter of the rebels," alluding to the extirpation of *Taiping* hordes under the famous *Shih-ta-k'ai*, which was consummated exactly at this very spot in 1863.

Most of the carriers are natives of the *Chia-ting* district. The chief market to which they repair for the purchase of eggs is the large village of *Tê-ch'ang*, on the right bank of the *An-ning* river, in *lat.* 27° 24'. Those who are unable to procure eggs, the supply of which is variable and not seldom insufficient, travel to *Hui-li-chou* and return with a burden of Yünnan opium. The egg-carriers mostly take the route by *Fu-lin* and the *So-i-ling* pass to *O-mi-hsien*, which is the shortest; others prefer to go by *Fu-lin*, the *Fa-hsaing-ling* pass, and *Ya-chou ;* a certain number go round by *Tung-ch'uan Fu;* a few choose a circuitous way by *Fa-chien-lu*, which affords the advantage of coolness. On reaching the *Chia-ting* plain the galls are attached to the trees with as little delay as possible.

Such is the history, so far as I could ascertain it, of the life and adventures of the wax insect. I cannot at any rate be in error as regards its shape and appearance. But on comparing the testimony of Mr. T. T. Cooper, the only other traveller who reports that he has seen the creature, a downright contradiction appears. He writes that near *Wei-see*, on the Tibeto-Yünnan frontier, he noticed for the first time the "white wax insect, which produces the famous so-called vegetable wax "of *Ssŭ-ch'uan*. The branches of the smaller trees and shrubs along "the road for a great distance appeared to be covered with snow from

" the quantities of these insects, resembling small moths of a very " delicate white colour with a fluffy tail curling over the back."* So precise a statement cannot be questioned, and the account of the *fluffy tail curling over the back* is supported by what Dr. Wells Williams records of a similar insect. "The *Peh-la-shu*, or white wax tree, " affords nourishment to an insect called *Cicada cimbata*. It is the " larva which furnishes the wax. The fly was first discovered by " Staunton on the coast of Cochin China ; it has curious pectinated " appendages on the back, and the whole insect is covered with a white " powder, which is imparted to the stems of the plants it inhabits, and " from whose bark it is collected by the natives."†

These descriptions differ so widely from what I saw of the *Chien-ch'ang Coccus*, that there is no way of explaining the discrepancy unless on the supposition that Mr. Cooper's insect belongs to a totally different species. I am all the more disposed to accept this solution, since I observed in the groves round Chungking certain kinds of bamboo in the autumn apparently splashed with whitewash, and found on close inspection that the phenomenon was caused by a kind of wax in course of secretion by a small insect provided with two plumes which spring from its hindquarters and wave continually over its back. But this wax is much too sparse and foul to be utilised commercially.

The production of insect-wax, however, is by no means confined to *Ssŭ-ch'uan*. A wide field of inquiry awaits the explorer of this and many similar subjects. Baron V. Richthofen, as above quoted, cites Shantung, Chêkiang, and Fuh-kien as provinces which furnish the product. The late Mr. Consul Markham found it in the Ningpo hills, and from other sources I gather that it is grown in the province of Honan, in the island of Hainan, and in Japan. What may be the nature of the insects which furnish the various kinds can only be discovered by travel and leisurely observation, and it should not be prematurely assumed that they are identical with the *Coccus* of *Chien-ch'ang*. Even in Ssŭ-ch'uan there is a distinct variety, of which all I can learn is that the eggs are attached to trees, as in the culture of white wax, and that oak trees only are suitable, for which reason the product is called *Ch'ing-kang La*, or oak-wax. It is used for the same purpose as ordinary white wax, and is almost as hard, but acquires a brown colour from the oak bark.

The tree on which the insects are bred in *Chien-ch'ang* is called the " *Chung-shu*," or insect tree, and that on to which they are transplanted in *Chia-ting* is known as the " *La-shu*," or wax tree ; but either tree may be used for either purpose, and practically the two names are applied indiscriminately, except where precision of expression is attempted by natives of uncommon intelligence and experience. The insect tree is very common throughout *Ssŭ-ch'uan*, where it is also called "*Pao-kê-tsao*," a singular term which means "*crackling flea*," and is said to be derived from a peculiarity of the wood, which, when burned, jumps and sputters in the fire. It is a handsome umbrageous evergreen, twelve or fifteen feet high, having glossy pointed leaves about three inches long, much resembling orange leaves, but thicker, and of a deeper green, with perfectly smooth edges. I have observed it growing among orange trees near *Fu-lin*. The leaf stems spring in pairs, and not alternately, from the central twig. I was too late to see the flowers, but a description of them is supplied by Captain Gill.

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* "Travels *of a Pioneer of Commerce*," pp. 323 and 429. On his return journey Mr. Cooper traversed the *Chia-ting* district, and he describes the method of wax culture. But as he passed through in October, two months after the wax had been gathered, his account must have been taken from hearsay only, and he seems too hastily to have assumed that the insect is of the same kind as he saw near *Wei-see*.

† "The Middle Kingdom" : first edition, vol. i., p. 274.

"These trees," he writes, "are in appearance like an orange, with a "small leaf. They have a very small white flower, that grows in large "sprays now (20th July), covered with masses of blossom, and a strong "smell, which was not very sweet, filled the air."*

The wax tree of *Chia-ting* is kept polled so as to supply young shoots, and in this state it resembles a pollard willow, being reduced to a very ugly stump some eight or nine feet high. All over the *Chia-ting* plain it is planted on the divisions of the ricefields, in such quantities that at 80 or 100 yards distance from the traveller the trees close in upon one another, as it were, and shut out the view. The wax tree is deciduous. It has pointed ovate leaves of a light green colour, smaller than those of the insect tree, with leaf stems springing alternately from the twigs.

Passages from native works referring to the trees have been extracted and translated by Professor Stanislaus Julien, and are reproduced in the "Univers Pittoresque," in the volumes which treat of China. The Professor sums up his deductions in the statement that "the Chinese "rear wax insects from three kinds (of trees), of which two are well "known in Europe. They are the *Nŭ-chên* (*Rhus succedanea*, according to Adolphe Brogniart), the *T'ung-ch'ing* (*Ligustrum glabrum*, "according to A. Remusat), and the *Shui-chin* (recognised by A. "Remusat as *Hibiscus syriacus*.)"

These native names are† unknown in Ssŭ-ch'uan, but the description given above may perhaps aid botanists in judging whether they are justified.

The decline of so simple and curious an industry cannot be viewed without a feeling of regret, but the following figures show how the production and trade is failing. The export of eggs from *Chien-ch'ang* was—

In 1876 about 30,000 burdens.
„ 1877 „ 12,000 „
„ 1878 „ 1,200 „

A burden consists of 64 packets, each packet containing 18 Chinese ounces (or 24 English ounces) of eggs; but the heat of the journey hatching the insects *en route* reduces the weight by about one-third. One packet may be expected to yield nearly four *catties* (say five and a quarter English pounds) of wax. The production of wax has therefore been roughly—

In 1876, 10,000,000 lbs.
„ 1877, 4,000,000 „
„ 1878, 400,000 „

The cost price of the eggs in *Chien-ch'ang* ranges from 6*l.* to 12*l.* per burden, and about 26*s.* per burden must be paid at various points for duty and excise. For sale on arrival the price varies between 10*l.* and 30*l.*

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* "*The River of Golden Sand*," vol. ii., pp. 62, 63.

† From inquiries in drug-shops, however, I found that the berries of the *Pao-kê-tsao* are known as "*false Nü-chên*," and that "*true Nü-chên berries*," used in native medicine, are yielded by a tree named *T'ung-ching*. But the identification of the Chinese book-names of plants with local names is hopelessly involved and obscure, and little can be gained by the most wearisome research.

The market price of the wax in *Chia-ting* is about 9*l.* per hundredweight, having continuously fallen of late years. It is said that 20 years ago the price was as high as 70*l.* per cwt., but this seems quite incredible. There can be no doubt that the depreciation is consequent upon the enormous import of kerosene oil; but *Chung-king* merchants persuade themselves that it should be attributed to the invention of gas and its introduction into Shanghai.

(Signed) E. COLBORNE BABER.

Chung-king, 10th June 1879.

Revised and corrected, 30th September 1884.

(Signed) E. C. B.

Note.—The places mentioned above will be found in the map attached to my "Travels and Researches in Western China," published by the Royal Geographical Society. It will be useless to look for them elsewhere.

INSECT WHITE WAX.

The subject of Insect white wax may be briefly discussed under the following heads:—

I.—The Insect Tree.
II.—The Insects.
III.—The Wax Tree.
IV.—The Wax.

I.—*The Insect Tree.*

This tree is known to the Chinese in the extreme west of Ssu-ch'uan as the *ch'ung shu* ["Insect Tree"] and the *Tung ch'ing shu* ["Winter Green" or "Evergreen Tree"], while in the east of the province it is generally called the *Pao-ko-tsao* ["Crackling Flea Tree"] owing, as Mr. Baber has explained, to the sputtering of the wood when burned. It is probably the *Ligustrum lucidum* [?] of the botanist; but the specimens I am forwarding to Kew will decide this point. Although it is found scattered about the whole of Ssŭ-ch'uan, its chief habitat is the valley of Ningyuan Fu or Chien-ch'ang in the west of the province. It is an evergreen with leaves which spring in pairs from the branches. They are thick, dark green, glossy, ovate, and pointed. In the end of May or beginning of June the tree bears clusters of small white flowers which give place to small seeds of a dark blue colour.

II.—*The Insects.*

In the month of March 1883 I passed through the Chien-ch'ang valley; but, knowing that Mr. Baber had already reported on the subject of white wax, I confined myself to a mere cursory examination of the insect tree. In this month I found attached to the bark of the boughs and twigs, numerous brown, glazed, pea-shaped excrescences or galls in various stages of development. In the earlier stages they looked like minute univalves clinging to the bark. The larger galls were readily detachable, and when opened, presented either a whitey brown pulpy mass or a crowd of minute animals whose movements were only just perceptible to the naked eye.

During the present year, in the month of May and June respectively, I had the opportunity of examining these galls and their contents with some minuteness in the neighbourhood of Ch'ungk'ing and within the jurisdiction of Chia-ting Fu, the chief wax-producing country in the province.

In the former case I should state that the insects have reached Ch'ungk'ing and its neighbourhood from Chia-ting Fu by short annual stages, being propagated on the insect tree in the country lying between these two cities. Thirty *li* to the east of Ch'ungk'ing I plucked the galls from the trees and on opening them, they are very brittle, I found a swarm of brown creatures, like minute lice, each with six legs and a pair of club *antennæ*, crawling about. The great majority of the galls also contained either a small white bag or cocoon enclosing a chrysalis whose movements again were visible through the thin covering, or a small black beetle. This beetle also has six legs, and is likewise provided with a long proboscis armed with a pair of pincers. It is called by the Chinese in Chia-ting the *Niu-êrh* or "Buffalo," probably from its ungainly appearance. I carried several of the small white bags home with me, and found that within a few days each chrysalis developed into a black beetle or "buffalo." If left undisturbed in the broken gall, the "buffalo" will, heedless of the wax insects which begin to crawl outside and inside the gall, continue to burrow with his proboscis and pincers in the inner lining of the gall, which is apparently his food. The Chinese declare that the beetle eats his minute companions in the gall, or at least hurts them by the pressure of his comparatively heavy body; and it is a fact that the galls from Chien-ch'ang in which the beetles are numerous are sold cheaper than those in which they are absent. A careful examination, however, has forced me to the conclusion that the beetle is there for a far more useful purpose. When a gall is plucked from the insect tree an orifice is disclosed where it was attached to the bark. By this orifice the wax insects escape. If, then, the galls remain attached to the bark, how can the wax insects escape from their imprisonment? I carried back with me a bough with a number of intact galls clinging to it, and watched day by day for signs of life. At last my patience was rewarded by seeing the pincers of the beetle gradually boring a hole through the gall. This hole, when completed, was circular and of sufficient size to allow him to escape from his imprisonment. Although he did not issue when he had broken his prison wall but continued to burrow in the inner lining, the wax insects began to crawl out and in, and I am persuaded that the beetle is a wise provision of nature to afford an outlet for the wax insects. That the beetle devours the insects, may well be doubted, for I endeavoured, but without success, to feed him with the daintiest morsels, he always turned away and recommenced burrowing. When I removed the beetles from the galls some of them made efforts to fly; but at that time their *elytra* were not sufficiently developed, and they had to content themselves with crawling, a movement which, owing to the long proboscis, they performed very clumsily.

There is another insect called the *La kou*, or "Wax Dog," which plays a part in the production of white wax; but, as this creature develops on the wax tree, I will refer to it under the head of *wax*.

At Chia-ting I examined galls that had been brought from the Chien-ch'ang valley. They were suspended on the wax trees and were for the most part empty; but in the very first I opened I found a solitary "buffalo"; the insects had all escaped through the natural orifice.

The Chien-ch'ang valley is the great insect-producing country; but given a number of galls with insects and the insect tree, the insects may be propagated elsewhere, as in Chien-wei Hsien, in the south of Chia-ting Fu, and even in the neighbourhood of Ch'ungk'ing. These latter insects are, however, declared to be inferior and fetch a lower price.

Mr. Baber has graphically described the annual headlong flight of the insect carriers across the mountains from Chien-ch'ang to Chia-ting; but I should mention that their flight is not confined to the night. In 1882 I met insect carriers hurrying in the heat of the day through Kuei-chou to the province of Hunan; but, owing to the greater length of the journey, it is just possible that they were travelling both night and day. The galls I saw in Kuei-chou were packed loose in trays in long bamboo baskets, through which a current of air could freely pass. In Chien-ch'ang, on the other hand, the galls are made up in paper packets, each weighing about 12 Chinese ounces, and a load usually contains 60 odd packets. At their resting places the carriers open up and spread out the packets in cool places in order that the heat may not force the insects to escape from the galls during the journey. As it is, a packet on arrival in Chia-ting is usually an ounce lighter than in Chien-ch'ang. In years of plenty a packet of insects laid down in Chia-ting costs about half a tael; but this year only about a thousand loads are said to have reached Chia-ting from Chien-ch'ang and about thirty loads from Chien-wei. The consequence is that the price has risen to a tael a packet for Chien-ch'ang insects. Chien-wei insects are inferior and cheaper.

In good years a packet of Chien-ch'ang insects will produce three to four catties of wax, the present price of which is about forty taels a picul. In bad years not more than a catty may be expected from a packet, so that altogether the trade has a considerable element of risk in it.

In Chia-ting the insects are divided into two classes called respectively the *La-sha*, or "Wax Sand," and the *Huang sha*, or "Yellow," or "Brown" sand. The former, which are of a reddish white colour, are declared to be the wax producers, while the latter, which are of a brownish colour, are said to produce no wax.

III.—*The Wax Tree.*

This tree, which is known to the Chinese as the *Pai-la-shu*, or "White Wax Tree," is cultivated extensively within the prefecture of Chia-ting, more especially within the O'mei, Lo-shan, and Chien-wei districts. It is, I am told, also grown in the north of the province, but nowhere else have I seen or heard of it. It is usually a stump varying from three or four to a dozen feet, the average height may be taken as six feet, with numerous sprouts or branches rising from its gnarled top. The leaves spring in pairs from the branches; they are light green, ovate, pointed, serrated, and deciduous. The branches are rarely found more than six feet in length, as those on which wax is produced are cut from the stems with the wax. The sprouts of one and two years' growth are too pliant, and it is only in the third year, when they are sufficiently strong to resist the wind, that wax insects are placed on them. In June some of the trees were bearing bunches apparently of seeds in small pods; and the specimens I am forwarding to the Director of Kew Gardens will probably suffice to identify the tree.

IV.—*The Wax.*

The wax insects which reach the wax tree districts from Chien-ch'ang and Chien-wei about the beginning of May, are made up into small packets of twenty or thirty galls, which are inclosed in a leaf of the wood-oil tree, whose edges are fastened together with rice straw. These small packets are then suspended close to the branches under which they hang. A few rough holes are made in the leaf by means of a large needle, so that the insects may find their way through them to the branches.

On emerging from the galls the insects creep rapidly up the branches to the leaves, where they remain for 13 days until their mouths and limbs are strong. During this period they are said to moult, casting off "a hairy garment" which has grown in this short period. They then descend to the tender branches, on the under sides of which they fix themselves to the bark by their mouths. Gradually the upper surfaces of the branches are also dotted with the insects. From the spots where they fix themselves they are said not to move, and I have watched them thickly studded on the bark apparently motionless. The day after removing a branch from a tree, however, I have seen them rushing about wildly, and it may be that they derive their nourishment from the bark; but, unfortunately, I have no microscope sufficiently powerful to discover the nature of their food or the method of excreting the wax. The Chinese idea is that they live on dew, and that the wax perspires from the bodies of the insects. Be this as it may, the specimens of the branches encrusted with the wax show that the insects construct a series of galleries stretching from the bark to the outer surface of the wax.

But I must here introduce the *La kou*, or "Wax Dog," which is developed in the early stage of wax production. I was unable to obtain a specimen of this insect; but it was described to me as a caterpillar in size and appearance like a brown bean. I have a theory, which, however, is unsupported by outside evidence. It may be assumed that there are both sexes of the beetle or "buffalo." On emerging from the gall the beetle is at first unable to fly, or at least unable to fly far, and both sexes doubtless remain for a time among the branches of the wax tree or the insect tree as the case may be. My theory is that the female beetle deposits eggs on the boughs, and that the "wax dog" is the offspring of the "buffalo." I will not go further, but there may be some connexion between this caterpillar and the galls containing the wax insects.

It is said that during the night and early morning the insects relax their hold of the bark, and that during the heat of the day they again take firm hold of it. I saw the owners of the trees moving from tree to tree armed with thick clubs, wherewith they belaboured the stumps in order to shake off the "wax dog," which they assert destroys the wax insects. After the first month or so, however, when the branches are coated with the wax, the "wax dog" is unable to reach the insects, and the trees are no longer belaboured.

Wind and rain are greatly dreaded when the insects are first suspended on the trees, for the tiny creatures are liable to be blown away or drowned.

I have said that white wax is produced in the neighbourhood of Ch'ungk'ing; but, as the wax tree does not grow so far east, the galls containing the insects are taken from one insect tree and placed on other insect trees. This production is inferior in quantity and quality.

When the wax is ready the branches are lopped off, and as much of the wax as possible is removed by hand. This is placed in an iron pot with water, and the wax rising to the surface at melting point is skimmed off and placed in round moulds, whence it emerges as the white wax of commerce. The wax which cannot be removed by hand is placed with the twigs in a pot with water, and the same process is gone through. This wax, as might be expected, is less white, and of an inferior quality. Not satisfied, however, that all the wax has been collected, the operator takes the insects, which have meantime sunk to the bottom of the pot, and placing them in a bag squeezes them until they have given up the last drop of their special product. They are then, an ignominious ending to their short and industrious career, thrown to the pigs.

When I was in Chia-ting in June, the market price of white wax was 40 taels a picul, but, owing to the anticipated decrease in the production of the present year, a rise was soon expected.

White wax is used chiefly in the manufacture of candles. Mr. Baber has pointed out that this wax melts at 160 degrees Fahrenheit, whereas tallow, which forms the general bulk of the candles, melts at 95 degrees. In Ch'ungk'ing an allowance of 3½ mace of white wax is melted up with each catty of tallow to give the latter greater consistency, and the candles of this mixture are dipped in melted white wax, which gives them a harder sheathing and prevents the tallow from running over when they are lighted.

(Signed) ALEX. HOSIE.

Ch'ungk'ing, July 21, 1884.

NOTES ON THE PRODUCTION OF INSECT WHITE WAX IN CHINA.

Having read the interesting reports of Mr. Baber and Mr. Hosie on the production of insect wax in the province of Ssŭ-ch'uan, I am induced to offer a few notes on its production in China generally, accompanied by some translations from Chinese authors, which may perhaps throw a little additional light upon the subject.

The earliest mention of this wax in Europe appears to be in Martini's *Novus Atlas Sinensis*, a short geographical description of the provinces of China, published in 1655, after the return of the author after a residence of ten years in the country. It is referred to among the productions of two provinces.

"Urbs Te-gan (prov. Hu-quang).

"Est in hac regione rarum quid, *Alba Cera*, quae a vermiculis elaboratur eo fere artificio quo apes favos suos struunt. Sunt autem hi favi multo minores ac candidissimi, nec vermiculi culti sunt, aut domestici, sed inculti atque agrestes. Ex collectis favis candelas ut ex communi nostrate cera conficiunt, at longe magis alba sunt, a magnatibus, quod majori constent pretio, fere tantum adhiberi solent; nam praeter candorem odorem etiam suavem emittunt cum comburuntur, nihilque sordibus inficiunt aut foedant, licet guttae liquefactae investes incidant. Lumen etiam clarisumum, maximeque temperatum reddunt" (p. 76).

"Urbs Ping-lo (prov. Quang-si).

"In hujus urbis territorio reperitur *cera* illa *alba* ab animalculis illis insectis elaborata, de quibus supra dixi" (p. 145).

There is also an account of it in the *Nouvelle Relation de la Chine* by Gabriel de Magalhaes, published in 1668. He describes it (p. 173) as produced in the provinces of Shan-tung and Hu-kuang.

A more elaborate memoir was written by a third Jesuit missionary in China in 1752, *Mémoire sur la cire d'arbre envoyée de la province de Hou-quang, par le Père Chanseaume, de la Compagnie de Jesus*, published in the Lettres édifiantes XXIII., pp. 146–154—in which he gives an interesting account of personal observations on the habits of the insects and of the shrub, apparently a species of Ligustrum, upon which they flourished.

More recently the French Sinologue, Stanislaus Julien, has written *Nouveaux renseignements sur la cire d'arbre et sur les insectes qui la produisent, etc., extraits des auteurs Chinoises*, published in the *Comptes rendus de l'Academie des Sciences*, 1840 (pp. 618–625): and Daniel Hanbury a learned article on *The Insect White Wax of China* in the Pharmaceutical Journal XII. 1853 (p.p. 476–482).

In fact not a little has been written on the subject, and yet many of the trees on which the insect is raised have not yet been identified. The wax insect on the contrary is better known, and it has been introduced by the French into Algeria. Specimens were obtained from the neighbourhood of Ningpo by Fortune and sent to Westwood, by whom it was named *Coccus Pela.* This is a widely distributed genus, including the cochineal insect of Central America, the lac insect of China, the destructive coffee bug, and many of the pests of our own greenhouses. It has the following characteristics. The *female* has a thick, globular, wingless body, composed of 14 rings; small inconspicuous eyes; short antennæ with nine joints; a short beak, and the abdomen furnished at its extremity with two short threads. In the *male* the antennæ are long of 10 joints, the beak is absent, it has a single pair of rather large wings, and the abdominal threads are elongated. In the whole family of *Coccidæ* the females at least are always destitute of wings and remain fixed on the plants upon which they live, sucking the juice with their beaks or rostra buried in the vegetable tissue. They finally deposit their eggs without moving from the spot, and die very soon afterwards, the dried body serving to protect the eggs during the winter until they are hatched for the next year's campaign. The so called "gall" described in the reports is, therefore, the dried maternal cuticle inclosing the numerous ova. It incloses also the "beetle" or "buffalo" so graphically described by Mr. Baber, which would seem to be a parasite developed in the body of the female wax insect, ready to emerge, a fully formed insect, in the summer, serving may be, as Mr. Hosie ingeniously surmises, as a provision of nature to afford an exit for the newly hatched larvæ.

The wax insect feeds upon several different trees in China, occurring spontaneously or applied artificially to the trees, some of which are cultivated for the purpose, others wild. One of these has been named *Fraxinus Chinensis*, first described by Roxburgh in his Flora Indica (I. 148) and introduced from China into the Botanical Gardens at Calcutta prior to 1793. Fortune, in his Residence among the Chinese (p. 147), figures a small branch of this covered with the wax. He describes it as "growing abundantly on the banks of canals in the "province of Chekiang, as well as, more sparingly, in the province of "Kiangsu."

It is gathered from a shrub of the same genus in the metropolitan province of Chih-li. Dr. Bretschneider "observed the wax insect in a "wild state in the mountains west of Peking, where it lives on a species "of *Fraxinus* not yet determined. It is a shrub with small leaves, not "*Fraxinus Chinensis*, Roxb., judging from the flowers. The natives in "the mountains call it *la-shu* ('wax tree') or *sioa-k'uli* ('little k'u-li'),

" to distinguish it from the *tak'uli* (' great k'uli '), the *Fraxinus* " *bungeana*, DC., which is a tall tree with large leaves also frequent " in the same mountains." Dr. Bretschneider has sent to Paris seed of both of these species, which are now growing in the Jardin des Plantes.

Insect white wax is produced as far north even as Manchuria, according to the statistical account of the province, *Shêng-ching t'ung chih* (see Wylie's Chinese Literature, p. 36) in which, ch. xxvii. f. 37, the wax insects (*la ch'ung*) are described as of the size of lice, feeding upon the *hua chŭliu*, otherwise called *la t'iao* or wax twig tree, the small branches of which are collected and heated to extract the wax, which is noted to be somewhat yellower than the Ssŭ-ch'uan wax. This tree is doubtless also a species of ash (*Fraxinus*), it being mentioned in another part of the same book as affording strong and elastic handles for spears.

According to the *Kuang tung t'ung chih*, the statistical description of the Canton province, *pai-la* (" white wax "), is abundantly produced in the prefecture of Chiung-chou, in the tropical island of Hainan, on a tree called *ch'ing ch'ou shu*, described as an evergeeen resembling the *tung ch'ing*.

The insect is thus shown to range from Hainan in the south to Manchuria in the north, and from *Ssŭ-ch'uan* in the west to Kiang-su in the east, so that Mr. Baber is doubtless right in his conjecture that the wax may be produced in every province in China.

The *Chih wu ming shih t'ou k'ao*, the large illustrated book on Chinese Botany published in 1848, which is, I believe, in the Library attached to the Kew Herbarium, figures four insect wax-producing trees, giving a short description of each, which I will translate.

I. The Nü chên (Ch. xxiii. f. 23).

The Nü chên (Virgin tree) was included in the Pên ching (the most ancient book on materia medica) in the first class of drugs. It is now always commonly called Tung ch'ing (evergreen tree). Li Shih-chên says that the Nü chên has dark purple fruit, while the Tung-ch'ing has red fruit, and he is perfectly right. In the province of Hu-nan it is always called la shu (" wax tree ") and they gain much profit from the cultivation of wax upon it. There is also a hsias la shu (" small wax tree "), the branches, leaves, flowers, and fruit all similar, but the height not exceeding four or five feet. The Chui-huang pên ts'ao (a treatise on plants fit for supporting life in times of scarcity) gives Tung-ch'ing leaf-buds and leaves as eatable, pointing to this tree.

II. The Tung ch'ing (Ch. xxxv. f. 51).

The Tung-ch'ing (evergreen tree) is described in the Sung T'ose ching (an illustrated materia medica in 21 books, published by Imperial order in the 11th century) under Nü chên. The Pên ts'ao hang mu (the celebrated materia medica by Li Shih-chên) first distinguished it by its leaves being a little rounder and its fruit of red colour. It is commonly used to graft the *Olea fragrans* upon. Wax can also be produced upon it.

III. The La shu (Ch. xxxvi. f. 49).

The La shu (wax tree) is planted in the province of Kuei-chou at Kuei ting Hsien in groves, for the profitable cultivation of wax. They lop off the branches in place of which a mass of twigs sprout out which are again cut off, to grow thicker than ever. The trees line the two sides of the way like the rows of willows on the Government roads. The leaves are somewhat round, in the autumn it produces small pods, like those of the Ch'un (*Ailantus glandulosa*) but thinner and smaller, which hang down in the midst of the leaves. The Kuei hsin tsa chih (written by Chou Mi in the 14th century, v. Wylie l.c. p. 158), describing the method of cultivation of wax by tying pots to trees, the leaves of which are like the leaves of the Chu yü (*Boymia* [Evodia] *rutæcarpa ?*), perhaps refers to this tree.

IV. Hsiao la shu (Ch. xxxvii. f. 18).

The Hsiao la shu ("small wax tree") abounds in the mountains and hills of the province of Hu-nan. It is five or six feet high. The branches, leaves, and flowers all resemble those of the Nü chên but are smaller, and it produces small dark coloured fruit in great profusion. In Hu-nan two kinds of trees* are used for the production of wax, the yu la (lit. "fish wax") and the shui la ("water wax"). The Yu la tree is small and the leaves slender, the Shui la tree is tall with large thick leaves. The latter is the Nü chên, the former the plant here figured. Some call it the water tung ch'ing, the leaves being delicate and soft not very unlike those of the Tung ch'ing, also used for the cultivation of wax, but these are arbitrary distinctions based on the differences between cultivated and wild trees. The water tung ch'ing referred to in "Sung's Miscellanies" as having slender leaves and being profitable for raising wax insects is this tree. Li Shih ch'ên says there is a water wax tree with leaves like those of the elm on which insects can also be raised for the production of wax, which must be a different species.

In the descriptive portion (chang pien) of the same book, as an appendix to the account of the Nü chên tree, there is a special article compiled from older authers—On the Production of Wax (Ch. xix. f. 60, 63).

Wang chi, in the Pên ts'ao hui pien (a Materia Medica in 20 books " of the reign of Chia-ching (1522–67)), says:—" White insect wax is " different from the white sort of beeswax and is made by small insects. " These insects feed upon the sap of the tunch'ing tree, and after a long " time change into white fat, which adheres to the twigs of the tree. It " is said by some to be only the excrement of the insects sticking to the " tree, but this is wrong. In autumn this is scraped off and collected, " melted with boiling water, and then poured into cold water, when it " solidifies into a hard mass which when broken exhibits markings like " gypsum but is more transparent. It is mixed with fat to make candles, " which are much superior to those of beeswax."

Sung, in his Miscellanies, says:—" The seeds of the Tung ch'ing can be " planted or used for flavouring wine when the tree is full grown, the " eggs of the insect are hatched upon it in the fifth month and the wax " collected in the seventh month. It must not be entirely taken, but some " left till the following year, so that living eggs may be again taken in " the fourth month for the new crop. Having been dried in the sun, " and a cotton cloth tied over the mouth of an earthern steamer, the " wax is placed thereupon. A vessel is placed inside the steamer, and " when the water in the pan boils the wax flows down into the vessel. " It solidifies into a hard white substance used for the manufacture of " candles. The dregs are put into a silk bag which is placed in hot " oil. The wax is all extracted, and the wax can be at once made into

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* Cf. The Memoir of Père Chanseaume cited above.

" candles. When trees have been employed three years to feed the wax " insect they must rest for three years."

He says again :—" In the province of Ssŭ-chu'an, when the seeds are " sown they are first steeped for ten days in water in which rice has " been washed, then pounded to remove the shell. During the produc" tion of the wax all the undergrowth near the trees must be carefully " removed. Before the insects can be again raised the tree must rest one " year. When the wax is collected the wood must be all cut off and no " old branches left."

In the Nung ch'êng ch'üan shu (the celebrated Thesaurus of Agriculture compiled by Hsü kuang-ch'i, A.D. 1562–1633, a native of Shanghai, the learned patron of the early Jesuit missionaries in China often mentioned in Du Halde's Description as Paul Siu, Coloa, Premier Ministre d'Etat, his portrait being also given there: which Thesaurus was published by imperial command after his death, in 1640, in sixty books, illustrated by many woodcuts, Wylie, l.c. p. 76) we find :—

" There are two kinds of wax collected from the Nüchên tree, the one growing spontaneously, the other after the application of eggs, when it grows spontaneously it is not known whence the insects come, but all at once the tree is covered with a growth of white 'flowers,' the wax produced upon the branches like hoar frost or snow is known by the natives as 'flowers,' which is gathered and boiled into wax; next year the insect eggs are again hatched; and so on afterwards in continuous annual generation. If the method of raising the insects be unknown the tree is soon killed, whereas if the eggs are collected and applied, the process may be continued indefinitely. When the eggs are applied they are brought from another tree and put upon this tree. The process may be repeated either each year or in alternate years, either on the same tree or upon cuttings. Should the tree be very vigorous the insects may be put upon it every year; should it be weak and worn out it must be allowed to rest a year to regain its strength, being manured till it recovers its growth, when the insects can be once more put upon it. This is what Sung refers to when he says 'Cultivate one year, rest one year.' For cuttings, remove branches from the tree of over an inch in diameter and plant them, and when these have grown strongly put the insects on to produce wax. All the branches within three or four feet of the root must be cut off. After the wax has been collected manure must be applied at intervals and again during the winter. During the following year new branches growing out of the sides must be cut off as they appear, and the tree trimmed to make it grow up straight. The next year it must be again trimmed and constantly manured. The third year the wax insects may be raised upon it. On the fourth year again, and yet again on the fifth. After the collection of the wax the tree must again be trimmed, and so on in continuous succession. This is called 'After three years rest three years.' "

The insect eggs must all be put upon the tree during the first three days of summer (May 5–7), the adjoining branches having been cut off, leaving only an inch or so, in order that the insects may fix upon the wood. When the branches have been trimmed they are tied on in bunches of three or four up to ten "galls," or even singly. Rice is steeped in water for about half a day. The water is then poured off and the insect "galls," having been peeled, are soaked in the water for about a quarter of an hour. They are taken out and lightly wrapped in bamboo leaves, three or four large, six or seven small, "galls" in each bundle, tied up with grass and put into a clean earthen jar. If it be cloudy or rainy the "galls" may be left in this jar for some days, but if the weather be hot many of the insects would escape, and they must be put on at once.

When about to put on, the four corners of the little bundles must be cut off, so as to leave holes as large as small beans. They are then tied with grass upon the branches of the tree, in greater or less numbers, according to the size of the branches. They must be tied on branches about the size of the finger, not upon the smaller twigs nor upon the large branches. For some days after they have been tied on the birds will come pecking at the bundles to get at the eggs, and they must be carefully driven away. As the weather becomes warmer the insects begin to emerge from the bundles. At first they run up and down the tree, and if there be weeds at the foot of the tree many will be lost in the undergrowth instead of climbing, therefore the ground must be kept perfectly clear. Next they travel to the under surface of the leaves and fix themselves there. Some days later they remove to the branches and twigs, burying their beaks in the bark and sucking nourishment from the juices of the tree. Thus do they made the "flowers." When it is calculated that all have come out, the bundles are taken down and examined to see if any eggs are left, and if there are they are made into a new bundle and put on another tree.

In the beginning of October the "flowers" must be examined, for if left too long no wax will be obtained, nor will it be if they are not ripe; if too old it will be impossible to strip them off. When the time comes the tree may be stripped as it stands, or the branches may be cut off first. In both cases water must first be sprinkled on so that they may be easily peeled. If it be rainy or at early dawn while the dew still remains still better. After the wax "flowers" have been collected they are thrown into boiling water. The melted wax rises to the surface, and when cool is removed. The water is again boiled and more wax obtained. The dregs at the bottom of the boiler are taken out with a ladle. Should the wax not be clean it must be boiled again in the same way. When perfectly pure and still fluid a loop of string is let down into it, by which, when cold, it is drawn up as a solid cake of wax.

Immersing in this way the insect eggs in water, in which rice has been steeped, peeling them and wrapping them in leaves is the practice at Wu-chou (now Chin-hua Fu, in the province of Che-kiang). In Wu-hsing (now Hu-chou Fu, in the same province) the natives wait till the middle of May before they cut off the eggs, which they wrap up in bundles and hang upon the branches of the old trees to produce a new crop of wax. At Tsui-li (now Chia-hsing Fu) and in my own district the eggs appear spontaneously and produce wax, it not being necessary to bring them from other trees. It is evident that in the succeeding generations natural growth is the essential thing, and in my native country they say that with their own eggs, without regard to days of the month, they only wait till they have attained their full growth and are ready to be hatched, when they cut off the "galls" and put them on the branches.

It is the common method to remove the eggs in the beginning of May, and to the east of the province of Che-kiang, where the climate is hot and they bring their eggs from other parts, they are afraid of the insects being hatched and lost, and consequently fix this date. But Wu-hsing being north, and my own district still farther north than Wu-hsing, the natives of my country who go to Wu-hsing and to the east to buy eggs must cut off the eggs ten days later, so as to put them on towards the end of May. Those who come from the east to my district to buy eggs must, on the other hand, cut off the eggs before May. To the north of my country, where it is still colder, the insects must be put on even later.

When the insect eggs are not produced in the country they must be bought in other places, distant sometimes 1,000 *li*. Thus in the province of Che-Kiang, at Chin-hua Fu, where this industry is most flourishing, they buy the eggs in the prefecture of Shao-hsing, T'ai-chou, and Hu-chou. In the province of Ssŭ-ch'uan it flourishes most in Hsi-chung Hsien and in Chia-ting Fu, and they buy the eggs in T'ung-chuan Fu. The distance in all these cases amounts to several hundred *li*. The eggs of the wax insect are mature before May, and they may be suspended on the new trees some time before they are hatched. They must be conveyed with all possible speed, otherwise the insects will escape before they can be put upon the trees, to the great loss of the purchasers. Hence the common saying, "Swift horses for buying the wax insects." If they are wrapped in leaves in the way described above, and put into earthen jars, the insects, even if they are hatched, remain in the bundles, and a delay of two or three days before they are put on the trees is of no consequence.

From Chin-hua they go every year to Hu-chou, and from Chia-ting to Tung-ch'uan, to buy eggs, the eggs not being produced in their own country. When asked why, they reply, "Because Chin-hua and Chia-ting produce the 'flowers' only, not eggs." But at Chin-hua native eggs also occur, although their value is one-half less. At Chia-ting no eggs are produced, and the eggs brought there are 10 times dearer than their original cost at Tung-ch'uan. The reason of this is not clear. I have often thought over it, and it seems that a young tree will produce principally "flowers," an old tree principally eggs, a short tree many "flowers," a tall one many eggs. If many eggs are put on one tree it will produce principally "flowers," if only a few eggs principally eggs. Again, when brought from the north and cultivated in the south many flowers will be obtained, when brought from the south to the north mostly eggs. Thus the eggs brought from Hu-chou to Chin-hua produce only flowers, and those taken from Chin-hua to the province of Fuh-kien also produce "flowers" only; consequently at Chin-hua most of the eggs are sent to the province of Fuh-kien, while they send to buy others from Wu-hsing. If taken from Chin-hua to Hu-chou they would produce mostly eggs. So also when the eggs are brought from Tung-ch'uan to Chia-ting they produce "flowers" only, while Chia-ting eggs taken to Tung-ch'uan will produce mostly eggs, Tung-ch'uan being north of Chia-ting. The "flowers" are naturally fond of heat, the eggs prefer cold. The different productions of old and young, of tall and short, of northern and southern trees, depend on a similar cause.

Some say that the trees which produce "flowers" do not produce seeds, and that those which produce seeds do not produce "flowers." This may be sometimes the case, but it is not always so. Generally both "flowers" and eggs are produced together, and when desirous of saving the eggs one must not collect the "flowers" too early. Nothing can be seen of them till the following spring, when they appear scattered on the smaller branches of the tree as shell-like tubercles, which are full grown at the approach of summer. Thus the "flowers" and eggs are not seen together. The eggs, when full grown, have inside fatty matter of the consistence of honey, and if this come out they will be dried up and destroyed.

(Signed) S. W. Bushell, B.Sc., M.D., &c.
London University Scholar in Biology,
Corresponding Member of the Zoological Society.

REPORT ON THE PRODUCTION OF INSECT OR WHITE WAX IN THE PROVINCE OF ANHUI.

In compliance with instructions received from Earl Granville, conveyed to me in a despatch from Mr. Philip W. Currie, dated February 1st, 1884, I instituted inquiries relating to the production of insect or white wax in this district, and in the province of Anhui generally.

For some time my inquiries led only to directly negative results, and to show the difficulty I experienced in obtaining information on the subject, I may mention that I was at the outset assured, not only by the dealers in white wax in Wuhu, but by the Fastai, the chief local authority here (who was good enough to refer to official publications in his possession), that no white wax was produced in Anhui, nor in any other province of the empire besides Ssŭ-chuan. The dealers also scouted the idea that white wax was produced elsewhere, and it seemed that I should only be able to report that in this province no production took place.

While, however, making these inquiries, I obtained the loan of Father Rathouis' monogragh on the insect, and after its persual, as a last resort wrote to Father Seckinger, the head of the Jesuit Mission at Nganking, and it is from him and through him that I am indebted for such meagre information and specimens as I am able to supply; and I wish at once to acknowledge the obligation I am under to him for his kind interest in the matter.

The specimens of the wax insect examined and described by Father Rathouis, were supplied to him by Father Seckinger from the grounds of the Jesuit Mission at Nganking. Father Seckinger observed the white deposit on the branches of a shrub called the Tung ch'ing tree, which I have reason to believe is the common large-leaved privet, and after examination came to the conclusion that the deposit was made by the wax insect, and forwarded specimens to Father Rathouis for examination. The insect was undoubtedly produced spontaneously in this garden at Nganking, that is, no intentional transference of the insect had taken place. At the time of the discovery it was supposed that no insects existed, or at any rate no wax was cultivated nearer than the district of Pochou in the extreme north-west corner of Anhui, about 300 or 350 miles from Nganking. I have since discovered that this industry is carried on on a small scale in the neighbourhood of the district city of T'ung-ch'êng, some 80 miles from Nganking and 200 miles from Wuhu. The wax produced is consumed locally, and the production is comparatively trifling. The specimens forwarded direct to Kew Gardens were obtained near T'ung-ch'êng.

Pochou is the Anhui centre of a very considerable trade in white wax. The district throughout which it is produced is very large, and extends from Pochou into the provinces of Honan, Shantung, and Kiang-su. The quantity of wax produced in Anhui is small as compared with the production of the other provinces named. I cannot obtain any information as to the whole area of production, but it is undoubtedly very extensive; nor could I, without visiting Pochou, hope to gain any approximate estimate as to the total quantity produced annually. There is no communication except by land between Pochou and Nganking, and a journey of so extensive a nature is quite out of the question. A visit to Pochou and the neighbouring districts could not be accomplished with any useful result in less than two months, the expense would be very considerable, and even on the spot accurate information as to the quantities produced would be extremely difficult to obtain.

The wax produced near Pochou finds its way to market to the northward, and a considerable quantity also reaches Shanghai by the Grand Canal and other waterways. None of it comes to Nganking or Wuhu which fact no doubt accounts for the profound ignorance existing in Wuhu on the subject.

The quantity of the wax produced near Pochou is said to be quite equal to that of Ssŭ-chuan; there appears at any rate to be no such marked difference as to make it noticeable either one way or the other. I cannot learn when the industry was first introduced into Pochou, or that at any time insects were transferred from Ssŭ-chuan to Anhui. I am much inclined to think that it is indigenous, and its spontaneous appearance in the garden of the Jesuit Mission at Nganking tends to confirm this opinion. The insect is said to be identical with that of Ssŭ-chuan, or rather, as in the case of the wax, no difference is commonly known to exist. With such minute insects even specific differences would be invisible to unscientific eyes, and to the Chinese, so long as there was no startling divergence in the colour or quality of the habitat or size of the insect, it would be the same; most probably it would be so reckoned even if it differed essentially in all those particulars.

In Anhui, as in Ssŭ-chuan, the practice of transferring the eggs of the insect from one tree to another is customary. I have not been able to obtain any explanation of the reason for this from my informant. The following, which I suggested to him, he agreed to as probable and adequate.

The natural habitat of the wax insect would appear to be the Tung-ch'ing tree, a species I believe, as I have already stated, of large-leaved privet. This tree is little more than a shrub, and, like most evergreens, is of slow growth. If left to themselves, the insects would continue to live and produce wax on this tree, and probably when the value of the wax first became known, and the industry became established, this was the case, but gradually it was found that the collection of the wax on the scale and with the speed required for commercial purposes, necessitated the partial or total destruction of the trees on which it was spontaneously produced. It therefore became necessary to discover some quick growing tree of suitable habits to which the eggs could be transferred, and the subsequent operations completed. This tree was by accident, or actual experiment, discovered in the "*Fraxinus chinensis*," as it is called in Father Rathouis' monograph. It grows rapidly from slips, and in two or three years attains a height of 8 or 10 feet with a circumference of 7 or 8 inches. The Chinese call the tree the white wax tree (Pai-la Shu), and apparently know it by no other name. It is of a straight habit of growth, and when cut down is of considerable value, chiefly, it appears, for spear shafts and pike handles; so much is this the case that to raise a body of troops in or near the white wax district is called "levying five hundred or a thousand white wax staves." As I am assured by my informant that this is a common form of expression in that district, I think that we may conclude that the industry is widely extended, and that it has existed for a lengthened period.

The Chinese do not appear to attribute any property to the Pai-la tree tending to stimulate the secretion of wax. The whole country round Pochou is a dry level plain, no rice is cultivated, the plain is, however, fertile. The Tung-ch'ing tree and the Pai-la tree grow side by side, no difference whatever is said to exist in the situation in which they flourish, and the wax is collected and the insect bred on the same patch of ground. I am inclined to think that at Pochou the privet is not altogether essential to the production of the insect. It seems that when the wax has been secreted on the Pai-la tree, a selection of a sufficient number of the most thickly coated of the twigs and smaller branches is made, and that from these the next year's crop is raised.

The Pai-la tree is systematically cultivated from cuttings. Large nurseries are formed, and the young trees are planted out when they have attained a sufficient growth. They are sometimes formed into plantations of considerable extent, but I gather that for the most part they are grown round the fields, and that every small farmer of the district is engaged in a greater or less degree in the industry. The trees attain a suitable size in about three years. The eggs of the wax insect are then placed on them, and in due course, about the month of September, the wax has been deposited and is ready for boiling. The trees are then cut down, the branches are lopped, and the bark stripped from the main stem; the poles are then, as has been stated, used for various purposes.

Before the trees are cut down, a sufficiency of the most thickly coated branches are removed, and put in baskets which are placed in a warm airy room. As the weather gets cooler the room is very slightly heated. In the month of December the cocoons, which apparently by this time have been formed, are removed. They are placed in small boxes filled with cotton wool, and are kept during the winter in moderately warm rooms, from which all draughts are carefully excluded. In very cold weather the boxes are placed on slightly heated stoves. The precautions necessary for their preservation were described to me as being very similar to those for the conservation of silk worm eggs.

About the end of March, when the young insects are nearly ready to leave the cocoons, baskets about a foot long and seven inches wide are fastened round the stem of each of the Pai-la trees. In these baskets the cotton wool containing the cocoons is placed, and shortly afterwards the minute insects come out and spread themselves over the trees. I have been quite unable to ascertain whether the wax insect is subject to the attacks of other insects called the "La-mu" or "La-kou," but such probably is the case.

The wax is obtained by boiling the leaves, branches, and the bark of the Pai-la trees in iron pans. This operation is repeated several times until all the wax has been obtained. The wax itself is also subjected to repeated boiling for the purpose of removing all impurities. It is then finally poured into earthenware bowls and allowed to cool. Ssŭ-ch'uan wax as seen in the market here is made up into large discs about 5 inches thick and some 20 inches in diameter, weighing between 50 and 60 pounds. The average price of this wax in Wuhu is about 3*s.* a pound, and I cannot learn that of late years there has been any serious fluctuations in the production or the cost. The small quantities of Anhui wax (bought at T'ung-ch'êng) that I have as yet been able to obtain has evidently been cooled in much smaller quantities than that from Ssŭ-ch'uan. It is possible that after the wax has passed from the hands of the retail producer into those of the wholesale dealer it is run into larger moulds for the market. I cannot learn that any substance is added to the wax in the course of manufacture; it professes to be pure; that it is not adulterated is scarcely possible, unless indeed it has been found impossible to mix any extraneous substance with it without instant detection.

The uses to which the wax is applied are three in number. It is used primarily to coat candles made of vegetable* tallow with rush wicks. Candles manufactured for imperial use are said to be made entirely of wax. Its second use is to coat pills and boluses, simply to preserve the drugs ; the wax is not swallowed. Thirdly it is largely used whenever it is desired to put a gloss on articles of almost every description. The operation is always performed in the same way. The article to be glossed, be it fine paper, cotton fabrics, pictures, or the sides of the thick white soles of Chinese shoes, is first rubbed with a small quantity of the wax, and is then polished with a smooth stone rubber. I have been repeatedly informed, in reply to my inquiries, that this wax is never used to put a gloss on silk fabrics. I cannot of course vouch for the accuracy of this statement.

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* And animal tallow.

I must in conclusion add a word of apology for the meagreness of this report, which I hope on a future occasion to supplement, and for the incompleteness of the information at second and third hand with which I have been compelled to content myself. It has not, however, been possible for me to visit even T'ung ch'êng during the past summer. An expedition of the kind to be of much use would have necessitated an absence from my post that would not have been convenient at the present juncture. To obtain the specimens of the T'ung-ch'ing and Pai-la trees, the twigs coated with wax, the small specimen of the wax itself, manufactured on the spot, accompanying this report, I was obliged to avail myself of the services of a Chinese furnished me by Father Seckinger. The dried specimens are, I am afraid, not satisfactory in themselves or at all skilfully dried, but I trust they will prove sufficient to determine accurately the nature of the two trees. The wax coated candles were bought in Wuhu, and are coated with Ssŭ-chuan wax.

(Signed) B. C. GEORGE SCOTT,
Her Britannic Majesty's Consulate, Consul.
Wuhu, October 23rd, 1884.

CCCIII.—MISCELLANEOUS NOTES.

MR. WILLIAM GRANGER, Office-keeper and Store-keeper at the Royal Gardens, retired on the 30th April last, after forty-three years service. Mr. Granger was highly respected and esteemed by the whole staff at Kew, and his sympathetic disposition and high sense of duty had endeared him to a long succession of young gardeners, and materially helped to maintain a manly and self-respecting tone amongst them. In recognition of Mr. Granger's long and faithful service the Lords Commissioners of H.M.'s Treasury have granted him a retiring pension.

MR. GEORGE DEAR, a seed collector, in the employ of the Royal Gardens, has been appointed Time-keeper and Store-keeper in succession to Mr. William Granger.

Senecio sagittifolius.—Kew is indebted to Mons. E. André for a young plant of this remarkable *Senecio* which he discovered in Montevideo, and introduced into France in 1890. It forms a rosette of large leaves each over a yard in length and a foot in width, sagittate with laciniated edges, and a raised frill like midrib. The stem rises erect from the centre of the rosette to a height of six or eight feet; it is clothed with lanceolate erect leaves and bears at the apex an enormous corymb of daisy-like flowers, each over an inch in diameter and white with a yellow disc. In the garden of Mons. Lacroix in Touraine, a specimen of this *Senecio* in the open air last summer grew to a large size, and on being removed to a greenhouse for the winter, it developed a flower stem over six feet high and a corymb of 140 flowers. The Kew specimen flowered in March, and a figure of it has been prepared for publication in the *Botanical Magazine.*

Plants from the Shiré Highlands.—A small collection of living ferns and bulbous plants was recently received at Kew from Mr. John Moir, of Mandala, near Blantyre, in East Tropical Africa. They were packed in a small box and were entrusted to Miss Florence E. Turner, who took care of them during the voyage. Although they had been in the box from November to February, and had been at sea about a month, yet almost every one of the plants was alive on arrival. The fact that almost all kinds of living plants may be sent long distances in wooden boxes with ordinary care, and that seeds may be despatched in an ordinary canvas bag by post, without appreciable suffering, should lead to the introduction of many new and interesting plants from remote parts of Africa, from New Guinea, and other places in course of being opened by European enterprise.

Australian Alpine Plants.—In a communication to *The Garden* last year (Vol. xlii. p. 153), Mr. A. R. Wallace drew attention to the alpine and sub-alpine plants of Australia, and suggested that many of them would prove hardy in this country. It is remarkable that among the hosts of plants introduced into England from Australia in the early part of this century not one has hitherto proved hardy, but as Mr. Wallace said, "probably no attempt has ever been made to obtain "plants from the cold uplands for cultivation in this country." Acting on this hint, a copy of Mr. Wallace's paper was forwarded to Sir F. von Mueller in Melbourne, to whom we are indebted for a very large proportion of the living representatives of the Australian flora now at Kew, and whose zeal is shown by the following letter which accompanied a box containing two plants, both likely to live. He wrote "I had induced my assistant to ascend during these holidays Mount "Baw Baw (in Victoria), first scaled by me in 1860, and the only place, "except one other mount close by, where the sub-alpine *Wittsteinia* "*vaccineacea* grows. He has just brought living plants; so I send some "few at once to you, and along with it *Coprosma pumila*, trusting that "they will endure in the cigar case, packed in moist moss, the few weeks' "journey to you. The plant is sub-alpine and would require cold-house "treatment with you. . . . . I have sent berries repeatedly, but "the seeds seem never to have germinated. So far as I know the plant "is new to European culture. As a wondrous rarity it is a counterpart to "*Orphanidesia.*" *Wittsteinia* is a monotypic genus of *Ericaceæ*, with prostrate creeping stems and ascending branches a foot long, clothed with small thick roundish toothed leaves and solitary axillary flowers, with a small yellowish-green or reddish campanulate corolla ½ inch long. The fruit is a globular berry coloured like the flowers. It grows in the crevices of rocks and on rocky summits of the Baw Baw Mountains, and also in the Albert Range and sources of the Yarra, at an elevation of 3,500 to 5,000 feet. This plant, along with a single species of *Pernettya*, and three species of *Gaultheria*, form the only Australian representatives of the large order *Ericaceæ*. *Coprosma pumila*, Hook. f., is described as a prostrate densely-matted glabrous shrub, creeping and rooting sometimes to a great extent, with small ovate shining leaves and solitary terminal flowers ¼-inch long. It grows on snowy mossy plains on the Baw Baw and other of the Australian Alps, at an elevation of 4,000 to 6,000 feet. It is also a native of Tasmania and New Zealand. There are four other species of *Coprosma* in Australia, none of which is known to be in cultivation here. It is to be hoped that others beside Sir F. von Mueller will take up Mr. Wallace's suggestion, as the behaviour of the alpine plants of Australia under the very different conditions of out-door gardening here would be interesting to botanists as well as to horticulturists.

Dischidia rafflesiana, Wall.—Miss E. Sargant, working in the Jodrell Laboratory, has made a thorough investigation of the structure and development of the ascidia of *Dischidia rafflesiana* (see *Kew Bulletin*, 1892, p. 284), with the following results :—

The structure of the pitcher of *D. rafflesiana* is, in essentials, that of the leaf. The similarity is most striking in the younger stages of development of the pitcher, when its mesophyll is of uniform structure throughout, and resembles that of the mature leaf. The orientation of the usually bicollateral vascular bundles is such that their protoxylem is always directed towards the upper surface of the leaf, and the outer surface of the pitcher. This confirms Dr. Treub's view, based on the history of development of the pitcher, that its outer surface corresponds to the superior surface of the normal leaf. Certain structural differences which exist between the mature pitcher and the leaf are interesting in their bearing on the question of the function of the pitcher. There is nothing to suggest a carnivorous habit, as no secreting glands comparable with those of *Nepenthes* and other insectivorous pitcher-plants are to be found. The "processes" described by Dr. Treub are undoubtedly glandular organs, secreting mucilage and probably resin also, but they cease to be functional long before the pitcher is mature. These processes are common to the young pitcher and the young leaf. They occur at the base of the petiole, and on the superior surface of the lamina near its base, and a gland is also present at the apex of the lamina. The glandular and woolly hairs found on the young leaf and pitcher are also transitory structures, having no relation to the functions of the mature organ. In the normal leaf the stomata are about equally numerous on both surfaces (25 or 26 per square inch on each). In the pitcher there is a marked difference ; the inner surface has on the average 33 stomata per square inch, the outer has only 16. In the mature pitcher some of the outer stomata are closed by formation of periderm. There is more differentiation in the mesophyll of the mature pitcher than in that of the leaf. The cells near the outer surface in the former are of the same rounded form as those of the leaf, but more closely packed, and richer in chlorophyll. The cells towards the inner surface of the pitcher are irregularly branched, with numerous intercellular spaces, and, in fact, form a spongy parenchyma.

Dr. Treub has already remarked on the accumulation of detritus in the pitchers. It partly covers the roots, which are pressed against the inner surface. The rootlets are often flattened, and develop root-hairs more freely on one side, showing a tendency to become dorsiventral. This peculiarity, however, is not confined to the pitcher-roots. In the roots of *D. bengalensis*, a species which is destitute of pitchers, a still more marked dorsiventral structure was observed. The root-hairs adhere firmly to the particles of the humus contained in the pitchers. The roots, both those in the pitchers and those external to them, show several anatomical peculiarities described. These are published in the full account of the investigation in the *Annals of Botany* (1893, p. 243). The observations made all go to support the view that these ascidia serve as reservoirs both for water and for vegetable detritus, from which the roots derive nourishment. They also serve to condense, and thus to economise, the aqueous vapour given off in transpiration. Both as regards the morphology and physiology of these organs, the results of this investigation are confirmatory of those arrived at by Dr. Treub.

A Drift-seed from Swansea Bay.—Dr. A. Lloydd-Jones lately sent a seed of *Entada scandens* for determination. It was said to be exactly like one picked up in Swansea Bay, and supposed to have been conveyed thither by the Gulf stream. In all probability this is the correct explanation of its presence there, but of course a large handsome seed such as this is often brought away from the tropics by travellers. Two hundred years ago Sloane recorded (*Philosophical Transactions of the Royal Society of London*, 1696, xix. p. 298) the fact that this seed and three other West Indian seeds were commonly cast ashore in the Orkneys. And Linnæus (*Amœnitates Academicæ*, viii. p. 3), mentions this among other seeds thrown up on the Norwegian coast. Some few years ago, too, several plants of *Entada scandens* were raised at Kew from seeds cast up in the Azores. There is little doubt that in all these instances the seeds had drifted from tropical America obliquely across the Atlantic. But the most interesting point is that after floating for weeks, and may be months, in sea-water they retain their germinating power.

ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 78.] JUNE. [1893.

CCCIV.—TAGASASTE.

(*Cytisus proliferus*, L. var. *palmensis*, Chr.)

Very full information respecting the useful fodder plant known in the Canary Islands as Tagasaste has been given in the *Kew Reports*, 1879, p. 18; 1880, p. 16; 1881, p. 13; 1882, p. 22 and in the *Kew Bulletin*, 1891, p. 239. This plant was brought into notice by the late Dr. Victor Perez of Orotava, Teneriffe, and it was entirely through the personal exertions of this estimable gentleman that so much information has been obtained respecting it and that seed of so useful a plant has been placed at the disposal of persons in various parts of the world for experimental purposes. Dr. Perez sent many supplies direct to Kew with results that have already been recorded. During a visit to Teneriffe in the early part of this year I had many opportunities of seeing the Tagasaste growing and of realising how valuable it proved in dry localities unsuited to the growth of any other kind of herbage plant. This note is to be regarded as supplementing in a few particulars the general information already given in the *Kew Bulletin*.

The ordinary *Cytisus proliferus*, Linn. f., or "Silky Cytisus" is a plant widely distributed in Teneriffe. It is known locally as "Escabon." It was observed growing plentifully at elevations of 3,000 to 6,000 feet. According to specimens in the Kew Herbarium it is found also in Grand Canary but probably to a much less extent than in Teneriffe. It is not infrequently seen as a cultivated plant in English greenhouses where its silky leaves and abundant white flowers render it a very attractive object. In Teneriffe it forms a large bush or tree with a stout woody stem sometimes attaining a height of 8 to 10 feet. The branches are of a slender drooping habit plentifully covered with ternate leaves on short petioles. The leaflets are oval-lanceolate pointed at both ends and clothed on the underside by copious silky adpressed hairs. These hairs are generally white but in some cases they are fulvous or even of a rich brown colour. The flowers (also silky in bud), are snow-white when fully expanded and attached in loosely-packed umbels on the sides of the branches. The pedicels are of a rosy colour. After flowering the bud in the centre of each umbel usually grows out into a branch—an appearance of proliferation which has suggested the specific name. The pods are slightly narrowed at the base and produced abundantly. They are sinuous, oblong pointed and densely pilose in the young state. This is the typical plant known as "Escabon" ordinarily met with in the mountainous parts in Teneriffe. There are several forms differing slightly in the size of the leaves and the colours of the flowers. None of them, however, possess any special merit as fodder plants. The Escabon itself is seldom browsed upon by animals unless pressed by hunger and it probably contains cytisine—an active poisonous principle known to exist in the common laburnum and other members of this genus. The tagasaste on the other hand evidently contains little Cytisine for it is readily eaten by animals and especially those that have become accustomed to it when young. The tagasaste is known in the wild state only from the island of Palma where it grew originally on the hills above the celebrated chapel of Our Lady de las Nieves at an elevation of about 1,000 feet above the level of the sea. It acquired considerable reputation locally and it was gradually distributed by cultivation all over Palma. The first person who carefully studied the tagasaste and wrote about it was Dr. Victor Perez. He introduced it into cultivation at Teneriffe and published a pamphlet on its merits as a fodder plant nearly 30 years ago. The plant was quoted in Dr. Victor Perez's writings simply as an unnamed variety of *Cytisus proliferus*. Although in botanical characters it differs only in a slight degree from the type it has nevertheless deserved to be regarded as a distinct variety and to bear a distinguishing name. The name that might very appropriately have been associated with it was that of Dr. Victor Perez. As the matter now stands, however, the tagasaste has been described by Dr. H. Christ in *Spicilegium Canariense* published in Engler's "Botanische Jahrbuches," IX. 120, as *Cytisus proliferus* var. *palmensis*. This name therefore distinguishes the Palma *Tagasaste* from the ordinary Teneriffe plant—*Escabon*.

Cytisus proliferus, Linn. f. var. *palmensis* differs from the type by its more robust growth and a laxer habit. It often attains a height of 12 to 15 feet in good soils and all parts of the stem and branches are enveloped in leaves. In fact its very leafy character is one of the marked features of the plant. The leaflets are ovate oblong, somewhat obtuse and dark-green in colour. The young growths, as may be seen in growing specimens at Kew, are almost entirely destitute of the silky hairs so abundant on the species. Dr. Christ's Palma specimens were obtained on the margin of woods above Barranco Carmen and at Dolores in March 1884.

It only remains to add a few words respecting the economic value and the uses of tagasaste for fodder purposes. Like all Canary plants it sends its very long tap roots deep into the ground, and it is thus enabled to bear prolonged periods of drought without injury. In many instances tagasaste was the only plant that throve in loose volcanic scoria and ash. Bushes of it more than 20 years old, existing under the most arid conditions, were still yielding regularly large crops of fodder. A plant or two is cultivated near every cottage in the neighbourhood of Orotava, and it is planted along the principal roads, to afford food for the animals kept by the road labourers. The tagasaste evidently prefers a loose friable soil, for then its roots can penetrate far into the earth. It grows moderately well also in somewhat clayey soils, but it is impatient of stagnant moisture. The climate where the tagasaste thrives best is mild and equable. The plant is well known not to bear frost, but on the other hand, it will probably bear considerable heat, and it might on this account be suited for most tropical and sub-tropical countries with a friable soil.

As already stated the tagasaste is readily eaten by domestic animals. Cattle, sheep, goats, and pigs evidently thrive upon it. It is said not to be so suitable for horses in the green state. This is practically the only drawback to its general use when freshly cut. It makes, however, an excellent hay, and as a dry fodder or after being treated in silos its value is greatly increased. A sample of dried fermented tagasaste was forwarded to Kew by Dr. Perez through Her Majesty's Consul at Teneriffe in 1886. It is said that in this state tagasaste is particularly palatable to both horses and ruminants. Another interesting point about tagasaste is that its flowers are frequented by swarms of bees, and it has already proved at the Cape and in Australia of great value to bee-keepers. The late Dr. Schomburgk states that the tagasaste trees in the Botanic Garden at Adelaide " were covered with bees during the flowering " season."

In countries with bare hilly tracts denuded of forest tagasaste should prove of the utmost value. It requires no irrigation, and once it is planted it lasts for 20 years or more. When overgrown and cut down it yields excellent firewood. In very dry countries with light friable soils there is probably no plant that would so well repay cultivation as the tagasaste.

Further information may be obtained from the following publications: " De la Végétation aux iles Canaries," par le Dr. Victor Pérez et le Dr. p. Sagot, p. 12 (Extract du " Journal de l'Agriculture des pays Chauds," 1865–66); " El Tagasaste y su fermentación," por el Dr. Victor Pérez, Teneriffe, 1888; Report of the Botanic Garden, Adelaide, 1888, p. 5; " Le Tagasaste," fourrage important par Dr. Victor Pérez et Dr. P. Sagot publié sous la direction de Georges V. Pérez, Paris, 1892; " Cultures Tropicales," par Dr. P. Sagot et E. Raoul, Paris, 1893, p. 489.

D. M.

CCCV.—GREENHEART.

(*Nectandra Rodiæi*, Schomb.).

The Bibiru or Brown Greenheart tree of British Guiana (*Nectandra Rodiæi*, Schomburgk) is one of the most noted and valuable timber trees of Tropical America. It belongs to the natural order *Laurineæ*. According to Trimen, Miquel following Nees doubtfully refers it as a local variety to *Nectandra leucantha*, Nees, native of Brazil; but the figure he gives of that species (" Stirp. Surinam," t. 58), which is quoted by Meissner for *N. Rodiæi*, appears very unlike the Demerara Greenheart. The tree probably grows only in British Guiana, but is found abundantly there on rocky soils at a slight elevation in forests extending 20 to 100 miles inland from the coast. The tree often reaches a height of 60 to 80 feet with an erect trunk bare below and branched only at the summit. The bark is smooth, whitish-grey; the youngest branches are covered with a fine tomentum. The leaves are sub-opposite, on short peduncles, channelled above, about 6 inches long, oblong-oval, acuminate, entire, very shining above, rather paler beneath. The flowers are small, in axillary panicles. From the habit of growth of the tree the flowers are difficult to obtain. They possess a fragrant odour resembling jasmine. The fruit is roundish-ovoid, very blunt or sub-pyriform. The seed is solitary, very large, filling the fruit.

The only figure of this plant so far published is given by Bentley and Trimen (*Med. Plants*, t. 219). The bark of the greenheart possesses tonic and astringent properties, and it is known as Bebeeru, Biberu or Greenheart Bark. It has no marked odour, but its taste is strongly and persistently bitter and very astringent. From it is prepared sulphate of Beberia, a salt, if obtained, according to the directions of the British Pharmacopæia occurring as dark brown, thin, translucent scales, yellow when in powder with a strong bitter taste soluble in water and alcohol and entirely destructible by heat. As an astringent tonic in general debility and chronic conditions of the alimentary mucous membrane it appears to be specially suitable (*Bentley* and *Trimen*).

Of other uses of this plant it may be mentioned that the Indians in time of scarcity use the seeds in the preparation of a kind of bread. The wood of the Greenheart is, however, most valuable. It is hard and durable and in demand for shipbuilding and other purposes. Its merits in resisting the attacks of the Teredo have lately been strikingly shown in some experiments undertaken in Port Said in connexion with the works of the Suez Canal. The correspondence on the subjects having been obligingly communicated to Kew by the Secretary of State for Foreign Affairs, it is published in the *Kew Bulletin* for the purpose of drawing further attention to the properties of this valuable timber tree.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, February 16, 1893.

I AM directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before Mr. Thiselton-Dyer, a despatch as marked in the margin relative to experiments made with regard to the resistance offered by woods to the borer worm.

I am, &c.
(Signed) E. GREY.

The Assistant Director,
Royal Gardens, Kew.

BRITISH DIRECTORS, Suez Canal Company, to FOREIGN OFFICE.

MY LORD, Paris, 15th February 1893.

WE have the honour to transmit to your Lordship herewith a copy of a letter which has been received from the Suez Canal Company's chief engineer in Egypt as to some experiments which have been made at Port Said with regard to the resistance offered to the ravages of the borer worm (taret) by various kinds of wood.

Three piles of pine, oak, and greenheart respectively were placed in the arsenal basin at Port Said two years ago, and have recently been examined.

The result as shown on the sketch enclosed is that while the pine and the oak are almost entirely destroyed the Greenheart has suffered no injury whatever.

We have, &c.
(for the British directors)
(Signed) H. AUSTIN LEE.

The Most Honourable
The Earl of Rosebery, K.G., &c.

ESSAIS DE BOIS DE GREENHEART.

Monsieur F. de LESSEPS, Président-Directeur de la Compagnie à Paris.

Ismailia le 24 Janvier 1893.

POUR faire suite à ma lettre No. 8831, en date du 26 Décembre 1891, j'ai l'honneur de vous informer que nous avons fait arracher les 3 pieux en sapin, en chêne et en bois de greenheart qui avaient été battus, le 15 Janvier 1891, à l'angle N.E. du bassin de l'Arsenal à Port-Saïd, a côté l'un de l'autre, pour que nous puissions nous rendre compte de la résistance comparative du bois de greenheart par rapport aux autres essences usitées.

Vous trouverez, ci-joint, un croquis de la forme et des dimensions de ces 3 pieux dans la partie immergée.

Il résulte de l'examen de ces pieux (qui avaient m. 0.250 d'equarrissage lorsqu'ils ont été battus) que.

1. Le pieu en greenheart ne porte aucune trace de tarets ou détérioration quelconque.

2. Le pieu en chêne est fortement attaqué par le taret dans toute la partie immergée et qu'il a pénétré assez profondément dans l'épaisseur du bois pour réduire la partie indemne à une section de m. 0.180 × m. 0.180 en A du croquis ci-joint et à m. 0.200 × m. 0.200 en B.

3. Le pieu en sapin est complètement rongé par le taret et se trouve hors de service. La partie indemne en A se réduit à une section de m. 0.070 × m. 0.070 et en B à m. 0.140 × m. 0.140.

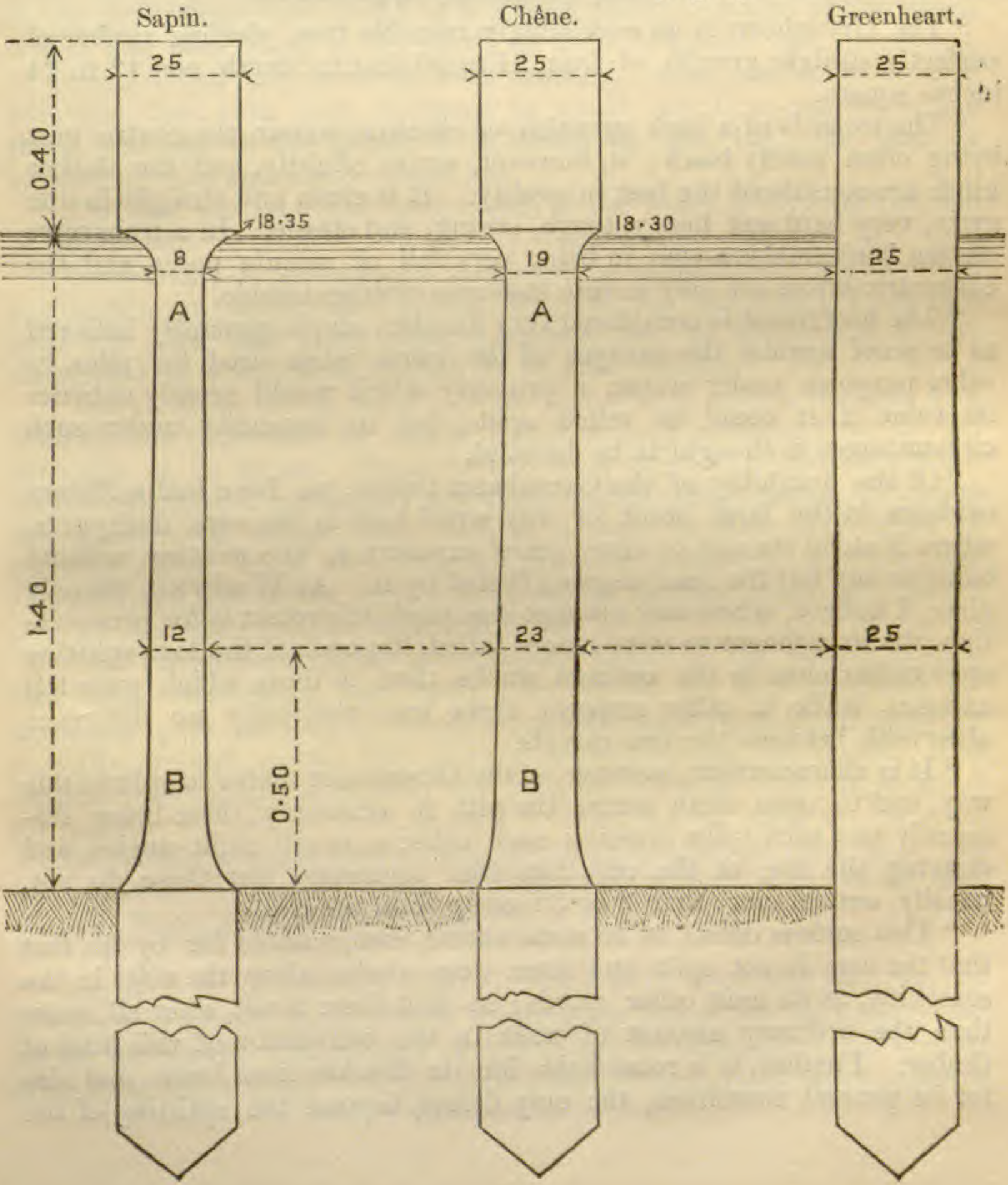
Ces essais ont donc démontré que le bois de greenheart offre une résistance aux tarets bien supérieure a celle du chêne et du sapin.

Pour déterminer dans quelle mesure nous aurions avantage à remplacer ces deux dernières essences par du bois de greenheart, pour la construction des ouvrages sous l'eau, il serait nécessaire que nous eussions la prix de revient du mètre cube de ce bois rendu franco à Port-Saïd, pour le comparer avec nos prix de revient des bois en chêne et de sapin.

Veuillez agréer, M................

L'Ingénieur en chef de la compagnie,

(Signé) Lemasson.



ROYAL GARDENS, KEW to FOREIGN OFFICE.

Royal Gardens, Kew,
February 22, 1893.

SIR,

I HAVE the honour to acknowledge the receipt of your letter of February 16, enclosing correspondence, herewith returned, with regard to the relative resistance offered by different kinds of wood to the ravages of the borer worm at Port Said.

The results are extremely interesting. The resistant properties of Greenheart were already well-known, but this is so striking and interesting an illustration that I propose to publish the correspondence in an early number of the *Kew Bulletin.*

The facts are of the more importance as the timber is the produce of one of our Colonies—British Guiana.

I am, &c.
(Signed) W. T. THISELTON-DYER.

Sir Edward Grey, Bart., M.P.,
Foreign Office, S.W.

The following detailed information respecting the characteristics and uses of Greenheart timber may be usefully appended:—

"The Greenheart is an exceedingly valuable tree, yielding timber of perfectly straight growth, of from 24 to 50 feet in length, and 12 to 24 inches square.

"The wood is of a dark greenish or chestnut colour, the centre part being often nearly black; it, however, varies slightly, and the darker kinds are considered the best in quality. It is clean and straight in the grain, very hard and heavy, tough, strong, and elastic. In a transverse section it resembles a cane in being very full of minute pores, and the concentric layers are only in rare instances distinguishable.

"The heartwood is considered very durable, and is generally believed to be proof against the ravages of the worm when used for piles, or other purposes under water, a property which would greatly enhance its value if it could be relied upon; but its immunity under such circumstances is thought to be doubtful.

"Of the durability of the Greenheart timber, we have had sufficient evidence in the large stock of this wood kept in the royal dockyards, where it stood the test of many years' exposure to the weather, without being in any but the least degree affected by it. At Woolwich, the only place, I believe, where any attempt was made to protect it for preservation, the experiment to some extent failed, the ends of the logs splitting open rather more in the covered stacks than in those which were left exposed, while, in other respects, there was absolutely no difference observable between the two parcels.

"It is characteristic, however, of the Greenheart timber to split in this way, and to open clean across the pith in seasoning, there being frequently two such splits crossing each other at nearly right angles, and cleaving the log, at the end, into four segments; but these do not, usually, extend more than 2 or 3 feet up from the end.

"This serious defect is, to some extent, compensated for by the fact that the logs do not split and form deep shakes along the sides in the seasoning, as do most other woods; so that there is not, after all, more than the ordinary amount of waste in the conversion of this kind of timber. Further, it is remarkable for its freedom from knots, and also for its general soundness, the only defect, beyond the splitting of the ends before mentioned, being a cross fracture of the longitudinal fibres, which is occasionally seen, but can seldom be detected before the log is under conversion.

"The alburnum, or sap of this wood, is of a dark greenish colour, and differs so little in appearance from the heartwood, that it is often difficult to distinguish the one from the other. In quantity it is usually excessive, frequently amounting to a fifth, and sometimes even to a third, of the diameter of the tree. Few people, however, regard it when appropriating this timber to works of construction.

"Owing to the difficulty of distinguishing the sap, many either dispute its presence altogether, or assert that if it exists it may be safely employed the same as the sap of Lignum Vitæ; this is, however, by no means certain, as I have found that if it is placed in any damp or imperfectly ventilated situation, it decays much sooner than the heartwood; but if used under more favourable circumstances its durability is very great.

"In connexion with this question a merchant and importer of Greenheart timber said upon one occasion, when we had a parcel under survey, that he was confident a certain log had no sapwood upon it, for if it had, it would be liable to the attack of a small worm, but that the worm would not touch the heartwood. The log referred to was accordingly tested by cutting off a thin cross section, and upon examination of the piece, there were found in it several marks or traces of the worm, which had penetrated to the depth of 2 to 3 inches; the heartwood, or duramen, had not, however, been touched. The gentleman at once admitted that, with such evidence, he would take it as conclusive that there was sap to the depth of 3 inches on the log, but that its appearance had entirely deceived him.

"The case was no doubt exceptional, as the worm is very seldom seen in this wood.

"Greenheart is extensively employed in shipbuilding for keelsons, engine-bearers, beams, shelf-pieces, &c., and for planking. It is also used for piles, and many other purposes, but its application to the domestic arts is somewhat limited by its great weight.

"The strength of this wood exceeds that of most others, whether it be tried by the transverse or tensile strain, or by a crushing force in the direction of its fibres. Tried by the latter process, it exhibits a peculiarity unshared, I believe, by any other timber except Sabicu. It bears the addition of weight after weight without showing any signs of yielding; and, when the crushing force is obtained, it gives way suddenly and completely, with a loud report, nothing being left of the pieces but a loose mass of shapeless fibres.

"The Greenheart timber is not usually hewn in the perfect manner that Teak, Mahogany, and many other woods are when prepared for shipment to the markets of this country, but comes from Demerara only partially dressed, a great deal of wane being left upon the angles. The butts are also almost invariably left with the snapped ends, as prepared for drawing out of the forest, instead of being cut off square. Its form should therefore be considered with the price quoted per load, as it will not compare favourably with well-squared timber." — (*Timber and Timber Trees*, *Laslett*, 1875, p. 151).

"Greenheart (*Nectandra Rodiœi*) is the only wood shipped from the Colony, and it and Mora (*Mora excelsa*) are two of the eight first-class woods at Lloyd's. The average weight of *cured* Greenheart is 60 lbs. per cubic foot, and a piece 12 inches broad and 1 inch thick will support a weight of 1,338 lbs. The average weight of Mora is 57 lbs. per cubic foot, and a piece 12 inches broad and 1 inch thick will support a weight of 966 lbs. In making these experiments the pieces of wood were supported at their ends. The specific gravity of Greenheart is 1.210, and of Mora 1.029.

* * * * * *

"When Greenheart was first exported from this Colony, one dollar per cubic foot was the usual price paid for the timber at the place of shipment; 28 cents. is the price paid at present for the same wood, but of inferior quality, the inferiority being due to the want of age and consequent want of durability.

"Greenheart does not grow over extensive tracts of country like Wallaba (*Eperua falcata*) and Bullet Tree (*Sapota Mulleri*), but seems to grow only near the rivers and creeks in a line inland from their banks of about two or three miles, and decreases in quantity as the rivers are ascended in the direction of the savannahs. In the clumps of trees that grow on the savannahs, and in the forest for many miles from its borders, I have never seen Greenheart growing. There is no Greenheart growing on the Cuyuni river above the Payuco Falls, two and one half days' journey from its mouth. Greenheart is used generally throughout the Colony in the construction of stellings, bridges, houses, boats, &c., &c., and in England for shipbuilding, dock-gates, piling, &c., &c. For all these purposes, when arrived at maturity, there can hardly be a better wood; but when young and sappy, it decays rapidly from the outside, and leaves a small core of durable wood, locally known as 'tacouba,' proportionate to the size of the original log. For proof of this see the piles of stellings and bridges.

"The Indian name of the tree is in the Arrawack Bibiroo: Accowois Rora-ék; and in the Carabisce and patois Dutch of the Essequebo, Sipiri.

"All the Greenheart cut in the Colony hitherto has been cut from the forests below or within a very short distance of the larger falls on the rivers, and owing to this limited space, the manner of conducting wood-cutting operations, and the cost of labour, combined, this tract of country is now being cut over in some places for the third time, and such trees as escaped observation or were thought too small to be cut previously, are now carefully sought for and cut down. The young saplings are cut down to make rollers on which to haul out the larger trees to water, and the seeds are collected and shipped to make Bibirine; thus, it seems to me, we are striving in the most expeditious manner possible to get rid of the Greenheart growing below the Falls." (*Mr. McTurk, before the Royal Agricultural Society British Guiana*, 14*th July* 1881.)

Nectandra Rodiœi, Schomb., the Greenheart tree. It is said there are three varieties of this, the Yellow, Black, and Mainop; they grow to tall trees in clay soil, and when near the rivers and creeks, attain large dimensions, yielding timber of a yellowish-brown colour, close in grain, very hard and heavy, the black variety being the heaviest. Greenheart is among the first-class woods at Lloyd's, and is an admirable timber for shipbuilding, engineering work, and for any purpose where great strength in scantlings is required. A fine log of Greenheart stood erect in the middle of the Court. This is now in the Timber Museum of the Royal Gardens, Kew. (*Colonial and Indian Exhibition*, 1886. *Reports*, *Timber*, *No.* 1, *p.* 451.)

CCCVI.—COFFEE ENTERPRISE IN THE EAST INDIES.

In a recent number of the *British North Borneo Herald* there appeared a short but interesting article on the history of the coffee industry in Ceylon from 1840 to 1870, and on the extraordinary development which has since taken place in that island in respect of tea cultivation. The favourable conditions which obtained in Ceylon in the early days of coffee planting are said by the writer to exist at the present time in British North Borneo, where the price of land is low, where freight charges are less than formerly, and where the present high price for coffee in European markets is likely to give rise to a flourishing industry :—

THE PRESENT HIGH PRICE OF LAND IN CEYLON : THE COFFEE ENTERPRISE IN 1840 AND IN THE FUTURE.

From the pages of the *Ceylon Times* we note a sale of Crown Land at Kandy on the 31st August of 244 acres at rupees 239 per acre or say, in round figures, 20*l.* per acre; there was keen competition at the sale.

The editors of the *Ceylon Observer*, Messrs. A. M. & J. Ferguson, in the pages of their wonderful Directory of Ceylon have given a history of the planting enterprise in Ceylon which will well repay perusal, and they therein exhibit in telling figures the extraordinary energy of the Ceylon planter. Commencing in 1824 little advance was made in the coffee enterprise in Ceylon owing to differential duties in favour of coffee grown in the West Indies, which were removed in 1835. Free grants in the first instance were made to planters, but in 1833 an upset price of 5*s.* per acre was fixed and sales could only be made at auction. A deposit of 10 per cent. was paid at once and the rest within one year, Government defraying all costs of survey. The grants contained the usual reserves as to roads, precious metals, &c.

Between 1833 and 1844 the sale of Crown Lands at 5*s.* an acre upset price covered 2,693 lots, comprising 267,373 acres, which realised 142,758*l.*, or an average of 10*s.* 8*d.* per acre. During this period a very large number of estates were opened, and the immense crops obtained by the early planters, combined with the high price of 4*l.* per cwt., raised visions of untold wealth. Mention is made of an estate that gave 19½ cwts. per acre in the third year after it was planted, and Sir Emerson Tennant gives a graphic account of the wild rush into coffee in 1844–45 :—" The Governor and the Council, the military, " the judges, the clergy, and one-half the civil servants penetrated the " hills and became purchasers of Crown lands. The East India Com- " pany's officers crowded to Ceylon to invest their savings, and capita- " lists arrived from England by every packet." In 1847 the withdrawal of the distinctive duties that protected British plantations from competition with the coffee of Java and Brazil brought ruin to the planters of Ceylon, and parchment was sold in Kandy at about 15*s.* per cwt. (The price to-day is 95*s.* !) Since then coffee planting in Ceylon has been attended with alternate success and failure, culminating in, say, the year 1870, when Ceylon exported over 1,000,000 cwts. at the average value of 50*s.*, since when the price has touched 130*s.* per cwt., while the export of coffee has steadily fallen to about 90,000 cwts. per annum. This has been brought about by exhausted soil and leaf disease, which brought ruin to the coffee planter in Ceylon, and forced him to turn his attention to other products; first to all, to cinchona, which at 10*s.* a pound for the bark seemed the planter's Eldorado, but so much was planted in the seventies that the export of bark from Ceylon rose from the round million pounds in 1880 to 11,000,000 in 1884, benefiting the world by enabling quinine to be sold at 1*s.* 6*d.* the ounce as compared with 12*s.* in 1880, but causing loss to the planters, who in some cases used the bark as firewood when the London price would not pay the freight. The old coffee lands and some of the cinchona lands have now been planted with tea in such quantity that the export has reached 70,000,000 lbs., and of a quality which has acquired world-wide fame, and the energy of the Ceylon planter has again achieved a hard and well-earned success. The price mentioned at the beginning of this article as lately paid in Ceylon for jungle land suitable for tea planting is not quite so high as the highest price paid in past years for coffee land, but it illustrates the value and the scarcity of suitable planting land in Ceylon. Some Ceylon men think the tea enterprise is becoming overdone, and would fain turn to their old love, coffee, but the difficulty in Ceylon is to find land suitable for coffee planting. The present high price of coffee and its likely continuance in the face of increasing consumption is bringing its cultivation prominently into favour, and the climate of the Malay Archipelago, which appears to be well suited to the coffee plant; and the success that is attending its cultivation, combined with the present high prices, is drawing attention to this part of the world's surface as a field for coffee planters. Free trade has done away with differential duties to some extent, and the coffee planter nowadays has little to fear from that source while attempting to supply the markets of the world with what has become such a necessary that its annual consumption has already reached the enormous amount of 850,000 tons, and is increasing, while prices are high and are rising. Here, in North Borneo, we can offer good land at prices similar to what were paid in Ceylon in the forties, and the planter will have less freight to pay, and can at present obtain a higher price for his coffee than the Ceylon planter of those days.

CCCVII.—PARASOL ANT.

The Parasol or leaf-cutting ant of Tropical America (*Œcodoma cephalotes*) is so destructive to cultivated plants that it has long been regarded as a serious pest. In the island of Trinidad an Ordinance has been passed known as "The Parasol Ants Ordinance 1890," for the purpose of eradicating the nests of these ants. As the ordinance is in some respects a new departure in regard to the destruction of an indigenous pest affecting cultivated plants, its provisions may be briefly noticed. The ordinance is permissive in its action, and provides that any person whose gardens or plantations suffer or are likely to suffer from the depredations of parasol ants may present a complaint to the warden of his district, who, after due inquiry, is empowered to give authority to the complainant to enter upon lands in his neighbourhood and destroy the ants' nests complained of. If the nests cannot be destroyed without injury to trees and growing crops, the complainant may be called upon to deposit a certain sum beforehand to compensate the owner and occupier of the land for any damage done. The ordinance, it will appear, provides for the destruction of the nests, not by the person on whose land they are found, but by the person who suffers from the depredations of the ants issuing from such land. When the complainant has obtained the necessary authority, he may enter at any hour of the day or night upon neighbouring lands for the purpose of discovering or fixing the locality of the nests, and when discovered he may destroy such nests without let or hindrance. Anyone obstructing the action of the warden in going over lands suspected of containing ants' nests, or molesting or threatening to molest any duly authorised complainant or persons employed in the work of inspecting or destroying ants' nests, renders himself liable to a penalty of ten pounds or imprisonment for three months with or without hard labour.

Various methods have been recommended for destroying ants' nests. The following are suggested by Mr. J. H. Hart, F.L.S., in a recent number of the *Agricultural Record* :—

"The best method of killing the ants when their nests are in the ground is by the application of coal tar or gas water; if in walls or buildings, by sulphur fumes, or any other poisonous gases driven in by bellows or centrifugal fan. A very effective and useful machine termed the 'asphyxiator,' used for the latter purpose, can be seen at any time at the Royal Botanic Gardens. The method known as 'puddling' is effective, as it destroys the food of the nest as well as the insects themselves, and consequently there is no inducement for a new colony to take up the same abode, but gas water or gas tar is just as effective, if carefully and properly used. In fact there are as many ways of killing the Parasol ant as of building a house, and where failure results the numerous methods are not in fault, but the want of care in the application of them."

The action taken by the Legislature in regard to the destruction of the Parasol ant in Trinidad has drawn fresh attention to the habits of this species, and very interesting information has been published respecting it. The most accessible account hitherto existing was that written by Belt in *The Naturalist in Nicaragua*. The results of recent investigations have confirmed Belt in the supposition that the ants cut up the leaves of plants and bring the pieces into their nest to serve as a pabulum on which to grow a fungus. In fact these pieces are used to form an underground "mushroom bed" and the ants use the conidial stage of the fungus for purposes of food for themselves and their larvæ. The Hon. J. E. Tanner, Director of Public Works, Trinidad, has given interesting particulars of the habits of the Parasol ant in the *Journal of the Trinidad Field Naturalists Club*, No. 3, August 1892. Mr. Tanner had two nests on a table in his house. In one nest with a queen, the ants readily supplied themselves with pieces of leaves from plants placed near their feeding ground. Each forager dropped his portion of leaf in the nest and it was taken up by a small worker and carried to a clear space to be cleaned. It was then taken in hand by the large workers, who after licking it with their tongues, reduced it to a small black ball of pulp. These balls were built on to the edge of the already formed fungus bed and slightly smoothed down. The new surface was then planted with portions of the fungus brought from the older parts of the nest. "Each piece is planted separately and " the ants know exactly how far apart the plants should be. It some- " times looks as if the bits of fungus had been put in too scantily " in places, yet in about 40 hours (if the humidity has been properly " regulated) it is all evenly covered with a mantle as if of very fine " snow."

A further and somewhat fuller account of the habits of two species of Parasol ants, believed to exist in Trinidad, is given by Mr. J. H. Hart, F.L.S., in *the Agricultural Record*, November 1892.

Mr. Hart states that by one species the pieces of leaves are formed into a dome over the mouth of the nest and then taken inside when required.

Mr. Hart has taken a good deal of interest in the subject, more especially in endeavouring to determine the species of fungus cultivated in so interesting a manner by these ants. Several communications were addressed to Kew, but the material unfortunately did not arrive in a living condition, hence it was impossible to determine to what species the fungus belonged. Nevertheless this material, in addition to a well-prepared microscopic slide, communicated by the Hon. J. E. Tanner, has enabled Mr. Massee to recognise it as the conidial stage of *Rozites gongylophora*, Möller.

An exhaustive memoir on "The Mushroom Gardens of some South American Ants" has quite recently been published by Alfred Möller.* The thoroughness of this work is in some respect due to the fact that the author studied his subject on the spot. He made his observations in the province of Santa Catherina, Brazil, in the neighbourhood of Blumenau, where ants of various species abound. The statements made by Belt respecting the cutting up of leaves by ants for the formation of a pabulum on which a fungus was grown that served as food has been corroborated. The method of leaf cutting, the various species of plants used, and the formation of the "mushroom gardens" are given in detail, but the most interesting and hitherto unknown portion is that relating to the fungus cultivated by the ants in their "mushroom gardens." A series of cultures has proved this to be the mycelium and conidial stage of a fine agaric, which according to the Friesian system would belong to the sub-genus *Pholiota* of *Agaricus*, but which has been called by Möller *Rozites gongylophora*. The agaric grows in dense tufts, and has a purplish, scaly pileus, 10–16 cm. across. The highest form of the fungus does not occur normally in the "mushroom gardens," but only the mycelium and conidial forms, and it is the last-named conditions that are eaten by the ants.

Observations were made by Möller on the "mushroom gardens" of ants belonging to the following genera, *Atta* (*Acromyrmex*) Mayr. (*A. discigera*, Mayr.; *A. hystrix*, Latr.; and *A. coronata*, Fabr.); *Apterostigma*, Mayr., and *Cyphomyrmex*, Mayr.

Although Möller did not directly study the fungus cultivated by the Trinidad species (*Œcodoma cephalotes*) there is now little doubt that it is identical with that described by him as *Rozites gongylophora*, and hence a very interesting problem in botanical investigation has apparently been solved.

CCCVIII.—WORMWOOD AS A FODDER PLANT IN INDIA.

In a recent letter received from Mr. J. F. Duthie, F.L.S., the Director of the Botanical Department, Northern India, he refers to the sea-side wormwood (*Artemisia maritima*, L.), most abundant in the Western Himalayas. This plant is a much branched, decumbent, or nearly erect under-shrub belonging to the *Compositæ*, more or less covered with close white cotton. It is found in sandy and muddy wastes, generally near the sea, and occupies large tracts of country bordering the Caspian and Black Seas. It extends round the Mediterranean to Western Europe, and, as already stated, it is found in the Westerm Himalayas. It is also abundant in Western Tibet in salt plains at elevations of about 9,000 to 14,000 feet.

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* *Die Pilzgärten einiger südamerikanischer Ameisen*, 1893, (7 pl.). Jena, Gustav Fischer.

Mr. Duthie finds that ponies feed upon this plant in the Himalayas "with relish," and he adds that "other species of *Artemisia* are "mentioned as affording good fodder for sheep on the Punjab "Himalaya." In localities where hardly any other vegetation exists, the use of the wormwood as a fodder-plant might prove of value. A bundle of dry leafy branches of *Artemisia maritima* was received at Kew from Mr. Duthie, and Professor A. H. Church, F.R.S., was good enough to undertake an analysis, in order to determine its nutritive properties. The results of Professor Church's investigations are contained in a memorandum reproduced below. It appears that the herbage of wormwood is not so valuable a food for horses and ponies as ordinary mixed grasses. It is, however, thrice as rich in albuminoids as the straw of European cereals, and to any animals not deterred from eating the plant by its somewhat sickly odour, it might prove under special circumstances, such as those which obtain in barren tracts and passes in the Western Himalayas, of considerable value.

DIRECTOR of the BOTANICAL DEPARTMENT, NORTHERN INDIA, to ROYAL GARDENS, KEW.

Botanical Department, Northern India,
Saharunpur, 28th September 1892.

MY DEAR DYER,

I AM sending to your address to-day a parcel containing a bundle of *Artemisia maritima*, the most abundant plant on the hillsides about Gilgit. Ponies eat it apparently with relish, and other species of Artemisia are mentioned as affording good fodder for sheep on the Punjab Himalaya. It would be satisfactory to have some sort of analysis of this Gilgit species regarding its value as fodder. The demand for fodder of any kind along portions of the Gilgit route is at present very urgent, owing to the large number of baggage animals employed in carrying stores of all sorts to Gilgit.

I hope we shall soon have a chemical analyst for India, but in the meantime, if you could help to obtain for me the information required regarding the above-mentioned plant, I shall be very much obliged.

I am, &c.,
(Signed) J. F. DUTHIE.

REPORT by PROFESSOR A. H. CHURCH, F.R.S.

Artemisia maritima, L.—Collected near Aster, North Kashmir, August, 1892.

I have submitted the sample to analysis, mixing the material together as uniformly as possible. The harsh woody texture of the plant and its powerful but sickly odour would not commend its use as the chief ingredient in horse fodder, but its chemical composition turns out more favourable than I expected. I think it is extremely probable that the aroma of this plant is chiefly due, like that of common wormwood, to *absinthol* ($C_{10}H_{16}O$) a liquid isomer of camphor. But a bitter principle called *absinthin* ($C_{40} H_{58} O_9$), which is found in *Artemisia Absynthium*, has the smell of wormwood and may be present in the present plant; to separate and identify it would, however, require a large quantity of material.

Per-centage composition of *Artemisia maritima.*

Water - - - - -	13·6
Oil, resin, wax, &c. - - - -	4·0
Starch, sugar, gum, &c. (by difference) -	34·2
Albuminoids (true) - - - -	6·0
Fibre - - - - -	33·9
Ash (includes 2·7 of sand and mica) - -	8·3

It should be mentioned that the 4 per cent. set down as "oil, resin, "wax, &c.," consists of the matters extracted by ether, of which it was found that three-fourths were soluble also in very strong alcohol, and were consequently for the most part resinoid and aromatic compounds. The albuminoids were determined by the phenol method: had they been calculated from the total nitrogen found they would have appeared higher (8·1 per cent.).

This plant contains rather less albuminoids, less digestible carbohydrates and more fibre than the average hay of mixed grasses. It is, however, thrice as rich in abuminoids as the straw of European cereals, which contain about 10 per cent. more fibre than this *Artemisia*.

(Signed) A. H. Church.

CCCIX.—COFFEE HUSKING IN LONDON.

The processes necessary for cleaning and curing coffee in tropical and sub-tropical countries entail a considerable outlay in buildings and machinery, and in many instances the produce is either shipped in an unsatisfactory condition or the industry is abandoned as beyond the means of small capitalists. The great difference that existed between "plantation" and "native coffee" in Ceylon years ago, and which now exists between "Blue Mountain" and "settlers'" coffee in Jamaica are believed to be closely connected with a proper system of curing the produce. Those with adequate means turn out good coffee, while the small cultivators with rude appliances can only turn out an indifferent quality. The prices obtained in the latter case are so low that large sums of money are annually lost owing to indifferent curing. This subject has for some years occupied attention in Jamaica, and it has been suggested that one means of improving the quality of the coffee raised by small growers would be to ship the produce to London after the pulp is removed and ensure that the subsequent processes are carried out on a large scale by efficient machinery in this country. The plan here suggested has already been successfully put into practice, and the results up to that time were given in the *Kew Bulletin* 1888, pp. 129–132. In a letter from Messrs. Lewis and Peat, dated 17th April 1888 (*ibid.* p. 132), they speak very hopefully of this plan of curing coffee:—"We beg to "inform you that the system of importing coffee in the parchment is "largely on the increase, and some most satisfactory results have been "obtained. We have recently sold large parcels from America which "were 'milled' here, and against 70*s.* per cwt. obtained last year for "the same coffee cleaned on the plantation we obtained 86*s.* per cwt.,

" although prices all round were lower. Experience shows that the " husk or parchment protects the bean from atmospheric influences " which affect the colour, and in every instance where trials have been " made the result has been in favour of cleaning here. The process is " quite simple, and the cost is 2*s.* 6*d.* per cwt., including everything. " The coffee must be pulped and the cherry got rid of on the plantation, " but the most important matter is the drying. It is absolutely neces- " sary that the parchment should be perfectly dried and kept from " moisture afterwards; insufficient drying is most damaging to after " results, and must have the greatest care."

The latest information respecting "husking" coffee in London is contained in the following correspondence addressed to Kew. The subject is of considerable importance to proprietors of coffee estates in the West Indies, and it is desirable to place such facts as bear upon it within their reach in a readily accessible form.

Mr. MARK B. F. MAJOR to ROYAL GARDENS, KEW.

Red Lion and Three Cranes Wharf,
Upper Thames Street, London, E.C.,
December 12, 1892.

DEAR SIR,

WHEN speaking to Mr. Haldane, of Messrs. Shand, Haldane, & Co., some little time ago, on the subject of coffee husking in London, he said he thought you would probably like to see a copy of the circular letter we drew up early in the year on the subject, and he kindly said I could mention his name. Knowing the great interest you take in all matters tending to promote the spread of accurate knowledge among growers, connected with the preparation of their produce, I have much pleasure in acting on his suggestion.

It was pointed out to my father, the late Mr. C. M. Major, about 1884, by a firm of coffee brokers in Mincing Lane, that as the business was already being carried on in Holland, it was a matter for important consideration whether it could not be established equally well over here, as otherwise there was a danger that coffee might be largely diverted from the London market when planters began to realise the convenience and benefit of the new method. As a result he approached Her Majesty's Customs, and was able to induce them to allow the husking of coffee to be carried on in bond, without undue restrictions, and he started the business in 1885, which has since become a considerable one.

The enclosed circular explains the most important points to be considered by planters, both as regards the preparation and advantages gained by shipping in the parchment. Should the subject prove sufficiently interesting to you, we should be pleased to show you over the husking warehouse, and explain the details of the process to you, and in that case you would no doubt arrange a day to call.

Believe me, &c.
(Signed) MARK B. F. MAJOR.

D. Morris, Esq., F.L.S.,
Assistant Director,
Royal Gardens, Kew.

[Enclosure.]

COFFEE HUSKING IN LONDON.

Red Lion and Three Cranes Wharf,
Upper Thames Street, London, E.C.,
March 1892.

Having been the first to erect machinery for husking coffee in London, and being frequently asked for a few particulars as to the treatment of the parchment, we venture to submit the following remarks to those of your friends who are interested in the question. At the outset we would mention that the operation is chiefly applicable to coffee treated by what is called in some countries the "West India Preparation," *i.e.*, to "washed" coffees, which are known by the trade here as "coloury." As these descriptions are most sought after by buyers, and command far higher prices than the qualities known as "unwashed," it is obvious that planters in their own interests should endeavour to market their crops in the former condition, the difference in price in a normal market being fully 20*s*. to 25*s*. per cwt. in its favour.

To obtain the best results, it is necessary that each operation, commencing with the gathering of the crop, should be performed with great care and discrimination. Only cherries of uniform ripeness should be plucked, as otherwise the pulping and most of the subsequent operations will be made difficult to perform, and the cleaned coffee will lack that uniformity of appearance and colour which is so highly prized by the buyers. The cherry coffee should be passed through the pulper (the machine for removing the pulp from the berries) as soon as possible after it is gathered, as the pulp is more easily removed before it has had sufficient time to dry and shrivel; care must be taken to see that the cherry pulp is thoroughly peeled from the berries, and as several of the latter will escape the action of the pulpers, sieves of a size which will allow only the free parchment coffee to pass through must be used, so that the cherries remaining in the sieves may be returned to the pulping machine. After pulping, the parchment coffee has to undergo a process of fermentation, and subsequently of washing in suitable tanks, when the adhering saccharine matter is got rid of; during this latter operation, it is of great importance that the parchment should be constantly stirred about, as by this means the light, black, and imperfect beans rise to the surface of the water, as well as sticks, leaves, and such like impurities, which should be skimmed off and treated separately. At no subsequent stage can this important object be attained in anything like so cheap and effective a manner, as the inferior beans can only be afterwards separated by hand-picking, a tedious and costly operation.

After washing, the parchment coffee has to be thoroughly dried, an operation requiring perhaps more knowledge of the article than any other, as on the way it is carried out depends to a very great extent the subsequent market value of the crop. If not sufficiently dried, the parchment becomes more or less musty in transit and the colour deteriorates, thus seriously affecting its selling value, and from the fact that the outer layer of coffee in the bags dries on the voyage to a greater extent than the bulk in the centre, it is impossible for us when we dry it here before husking to obtain an even result. In addition to this, freight and charges have to be paid on extra weight, which is an absolute loss; we may mention that many parcels we have received in a damp state have lost over 20 per cent. after drying, exclusive of the loss in weight naturally caused by the removal of the parchment. It will thus be understood that it is imperative the parchment should be properly dried, especially as extra charges are incurred for drying here. On the other hand, care must be taken not to over-dry the coffee, as otherwise the colour will be impaired to some extent, which will reduce the market value; it is therefore apparent that the greatest care and experience is required to ascertain when the parchment is in really prime condition. After drying, coffee intended for husking in London has only to be shipped without further loss of time.

The advantages to be derived by planters in forwarding their coffee in parchment are several. The parchment covering acts as a great protection to the bean, while in transit, from all the deleterious influences to which it is necessarily subjected while in the close hold of steamers, on quays, &c., and above all it preserves the colour. This is probably one of the greatest advantages of any, as the finer the colour of the coffee, the higher is the price paid by buyers, and it has been abundantly proved that coffee husked here fetches prices higher by several shillings a hundredweight than the same coffee when cleaned abroad. Planters are also enabled to market their crop, probably several weeks earlier, than if they have to wait to husk it themselves. A material saving of labour is effected in districts where it is scarce, or where the crop is a heavy one, at a time when it is extremely important all hands should be concentrated on harvesting, and when this is complete, on the more careful cultivation of the plantation, thus increasing its powers of production, and at the same time getting the husking of the coffee done as cheaply as it could be effected on the estate. The outlay on machinery and other incidental expenses would be saved, and capital that would be locked up is set free; further, the dangers of a breakdown are avoided, a very serious matter on estates, where every important piece of machinery has to be obtained some thousands of miles away. Receiving as we do many thousand bags of parchment coffee each year, we have necessarily obtained considerable experience in the manipulation, and are enabled to work each parcel in the way best calculated to meet the requirements of the trade in all its different variations.

The total cost of receiving from import ship, landing, husking, sizing, and all the usual operations is 2*s*. 6*d*. per cwt., which we believe is at least as cheap as it can ordinarily be performed by planters, if not cheaper. The charge for drying is extra, and depends entirely on the condition of the parcel, but from what we have already stated, it is a charge which, in their own interests, planters should never incur here. The loss in weight from husking varies largely according to the nature of the parchment, and ranges from about 15 per cent. up to, in a few exceptional cases, about 22 per cent. The average loss is from about 18 per cent. to 20 per cent. The whole of the various operations are carried out in our bonded warehouses, under the immediate supervision of the officers of the Crown, which affords an important guarantee to importers that the correct weight is returned to them; no customs duty is charged by the Crown authorities on the husk.

We have occasionally received parcels of coffee, dried in the cherry, to husk, but we cannot recommend this mode of shipment, though it is possible that in a few individual cases planters might find it desirable to adopt it. In the first place, it adds unduly to the charge for freight, the coffee never turns out of such fine colour as it does if prepared as already detailed, and, of course, the loss in weight after removal of the cherry and parchment covering is much heavier, besides it is much more difficult to work, and necessitates a charge of at least 3*s*. 9*d*. per cwt. The foregoing remarks apply solely to coffee of the Arabian sort. As regards Liberian coffee, we have no hesitation in advising, that unless absolutely compelled, shipments should never be made in cherry, as this species, even under favourable circumstances, is most difficult to work.

That the business has developed so largely since we commenced operations in 1884, appears to us conclusive proof that many planters are fully alive to the benefits to be derived by the adoption of this method for marketing their crops, and we therefore trust these remarks may be of special interest to those who are at present unaware of the facilities to be now obtained in London, and who have not suitable machinery on their estates for cleaning the coffee themselves.

(Signed) MAJOR & FIELD.

The following correspondence relating to the same subject is taken from the *Jamaica Post* of the 15th May 1893.

TO THE EDITOR OF THE "JAMAICA POST."

SIR,

IN response to an appeal from the Clarendon Agricultural Society, the board of the institute appointed a committee to visit the show recently held at May Pen.

As a result of their visit, the committee recommended that a special prize of two guineas be awarded to Mr. J. L. Hibbert for his exhibit of coffee for export in parchment, and the committee stated, that "they
" wished by their award to point out to small settlers, how desirable it is
" to export coffee in this manner, as it does away with the expense of
" milling, and saves both time and trouble. In Central America, the
" owners of large plantations have given up the use of expensive milling
" machinery, because they find that it pays them better to export coffee in
" parchment, and it is hoped that merchants and buyers of coffee in this
" island will give their attention to the question of the purchase of it in
" this form."

This prize was accordingly awarded by the board. As, however, their attention was drawn to a statement made by the Clarendon agricultural authorities, that there appeared to be some difference of opinion as to the advisability of the exportation, by settlers, of coffee in parchment, the board decided to invite the opinion of experts, and I am desired by them to ask you to be good enough to give publicity to the following report kindly supplied by Messrs. Park, MacFadyen and Co., which will, they think, prove of interest to all engaged in coffee planting.

I am, &c.

(Signed) FRANK CUNDALL, Secretary.

Institute of Jamaica, May 12th, 1893.

[Enclosure.]

REPORT from Messrs. PARK, MACFADYEN & CO.

COFFEE HUSKING IN LONDON.

At the outset we would mention that the operation is chiefly applicable to coffee treated by what is called in some countries the "West Indian Preparation," *i.e.*, to "washed" coffees, which are known by the trade here as "colory," and as these descriptions are most sought after by buyers, and command far higher prices than the qualities known as "unwashed," it is obvious that the planters in their own interests should endeavour to market their crops in the former condition. It sending over parchment coffee, great care should be taken to have it thoroughly dried before shipment, as to a very great extent, this affects the market value. If not sufficiently dried, the parchment becomes more or less musty in transit, and colour deteriorates, thus seriously affecting its selling value, and from the fact that the outer layer of coffee in the bags dries on the voyage to a greater extent than the bulk in the centre, it is impossible for us when we dry it here before husking to obtain an even result. In addition to this, freight and charges have to be paid on extra weight, which is an absolute loss ; and we may mention, that we have received parcels in a damp state, which show a loss of 20 per cent. after drying, exclusive of the loss in weight naturally caused by the removal of the parchment. It will thus be seen that the parchment should be dried thoroughly, especially as extra charges are incurred for drying here. On the other hand, care must be taken not to overdry the coffee, as that impairs the colour to some extent. The advantages to be derived by planters in forwarding their coffee in parchment are several. The parchment covering acts as a great protection to the bean while in transit, from all the deleterious influences to which it is necessarily subjected while in the close hold of steamers, on quays, &c. ; and, above all, it preserves the colour. This is probably the most important of all, as the finer the colour of the coffee, the higher is the price paid by buyers ; and it has been abundantly proved that coffee husked here, fetches prices higher by several shillings a hundredweight than the same coffee when cleaned abroad. Planters are also enabled to market their crop probably several weeks earlier, than if they did it themselves, and a material saving of labour is effected in districts where it is scarce.

CCCX.—CANARY ROSEWOODS.

(*Convolvulus floridus*, L. *Convolvulus scoparius*, L.)

One of the most interesting and striking plants in the Canaries is a shrubby convolvulus, known locally as *Guadil.* This was in flower in the neighbourhood of Orotova in the month of March last. It appears to be little known under cultivation in European gardens, although a single specimen exists in the collection of Mr. Thomas Hanbury, F.L.S., at La Mortola. This, together with a closely allied species to be presently described, is sometimes known as rose-root, and is said to yield oil of roses. The Guadil (*Convolvulus floridus*, L.) is, however, more interesting as an ornamental flowering shrub than for any economic purposes to which, at one time, it may have been applied. It belongs, as already mentioned, to the Bind-weed order (*Convolvulaceæ*), although nothing can be less like a convolvulus in habit, and is one of the comparatively few examples of this order (containing the jalap plant, the sweet potato, the scammony, and the showy ipomæas) possessing an upright stem and a tree-like habit. It may be described as a compact shrub from four to six feet in height, with a stout woody stem and numerous branches. The branches, especially in the young state, are white powdered, as also are the abundant linear undulate leaves. The latter are about three or four inches long, attenuated towards the petiole with rounded and somewhat emarginate tips. The flowers are abundantly produced in large loose terminal panicles. The sepals are ovate acuminate about two lines long. The corolla is about one-half to three-quarters of an inch in diameter, and pure white. The capsule is conical, and slightly villose at the apex. It is somewhat remarkable that so striking a plant has been figured but once, and that nearly one hundred years ago.

In Jacquin's *Icones Plantarum Rariorum*, t. 34, there is a long branch shown with the leaves clustered together at the apex and a few large flowers. This is scarcely characteristic of the habit of the plant, and the flowers are too large. When in flower the plant appears as if covered with newly fallen snow. It is one of the few native plants which awakens the enthusiasm of local residents at Teneriffe. As in other parts of the world these usually strive to grow unsuitable introduced plants and to neglect the many beautiful objects so well adapted to their soil and climate. According to Dr. Perez the *Gaudil* was an object of high regard by the Guanches, the aboriginal race of the island. This can well be understood, for when in flower it is one of the brightest and most attractive objects in the Teneriffe landscape. The pale powdered green of the leaves forms an excellent background for the masses of pure white flowers. The only pity is it is so rarely seen. In the search for rose-roots for export purposes this and the allied species have been nearly exterminated in the wild state. In Teneriffe it grows from sea level up to elevations of about 1,000 feet. It evidently prefers a free porous soil and thrives in exposed situations on rocks and slopes. A fine plant was growing on a stony mound at the farm belonging to Dr. George Perez near Puerto Orotava, and another was seen at the Botanic Garden near the same place. In rich soil the plant appears to put on a looser habit, and when laden with flowers the panicles become almost pendulous. In this country the plant would require the protection of a greenhouse and plenty of exposure to sun and air. During the winter, when in a dormant condition, it would be necessary to keep it rather dry. It is readily increased by seed, and as it is a fast grower it should flower in the second or third year.

Dr. Christ has published (in his *Spicilegium Canariense* in Engler's *Botanische Jahrbücher* IX. p. 125), a description of a new variety of this plant—*Convolvulus floridus*, var. *densiflorus*. The variety is distinguished by a more compact habit, shorter and broader leaves crowded near the ends of the branches, by a shorter panicle, and by much more numerous but smaller flowers. The variety was found near Ponta de Teno, Teneriffe, by Hillebrand. For cultivation in greenhouses in this country the variety with a compacter habit and more abundant flowers may prove a very desirable plant.

The other species included in this note is the plant more correctly known as rose-root, *Lignum rhodium* or rose-wood (*Convolvulus scoparius*). This, as its name denotes, is a convolvulus with the habit of the common broom. It is an erect shrub seven to eight feet high, with a few long narrow branches and somewhat short linear leaves. The flowers are produced in many flowered axillary cymes. The corolla is slightly plaited with a five-partite limb; it is tinged with red outside and white within. This is known locally as *Leña Noel* or *Leña Loel*. It is only rarely met with; Teneriffe specimens in the Kew Herbarium are from Guia on the South-western slopes of the island and from Barranco Santo. It is said to be more common at Palma, but owing to the excessive digging of the roots many years ago, for export purposes it is restricted to very few localities. There are several good figures of this plant. One of the best is that given in the "Botanical Register," 1841, t. 43, with a description by Dr. Lindley. This was from a plant grown at Milford near Godalming sent by Mr. Barker Webb.

There is a single specimen of the root of *Convolvulus scoparius* in the Kew Museum. It is about eight inches long, two and a half inches wide and one inch thick. The heartwood occupies about three-fourths of the entire diameter of the specimen, and is of a distinct orange yellow colour, very dense, marked by closely-lying annual rings and numerous, very fine medullary rays, the spaces between them being filled with small, partially open vessels. The sap wood is very much lighter in colour, and is comparatively soft and easily cut. It was sent to the Museum by P. Barker Webb about 1850, and still retains its rose-like smell. A sample labelled *Oil of Rhodium* is also in the Kew Museum, where it has been at least 35 years and probably longer. Sir William Hooker, in his first edition of the "Kew Museum Guide" published in 1855, mentions a sample of oil in the Museum at that period which is probably identical with that now existing. It is of a clear amber colour and possesses a distinct though not a penetrating odour of roses.

In Lindley's *Flora Medica* (1838), p. 400, there is the following note on this plant:—

"Wood perfumed, smelling strongly of roses, yellowish fawn colour veined with red, burning readily when lighted. Taste bitter, balsamic. Yields by distillation an essential oil of bitter balsamic flavour; little used, except, according to Feé, for adulterating oil of roses."

Appended to the description of *Convolvulus scoparius* in Edward's *Botanical Register* (1841), t. 43, Dr. Lindley states:—

"At all events this is the plant that yields *Lignum rhodium*, a wood smelling strongly of roses, yielding by distillation a bitter oil, and employed by perfumers for adulterating or altering oil of roses. The roots, which accompany the stems, as they are imported, are said to be much stronger scented than the stems. The old writers on drugs, misled by the name, imagined that this product must come from *Rhodes*, translating the name Rhodeswood, and after hunting in vain in the writings of either ancients or moderns for the plant that yields it, arriving at the erroneous conclusion that it was the Aspalath of the Greeks. It is, however, certain that the name really signifies wood smelling of roses. Oil of Rhodium is the name given to the oil obtained from this plant. The wood when powdered has been recommended to promote sneezing, and forms an agreeable snuff. It is valued for fumigation, and when burned diffuses a most delightful fragrance."

Mr. Barker Webb, in a note (*Bot. Reg.* (1841), App. p. 70) remarks:—

"The roots of both the original species (*Convolvulus floridus* and *C. scoparius*) are fragrant, and yield the so-called Oil of Rhodium by simple distillation, though the first in a less degree, or sometimes, when young, scarcely any. The original *lignum rhodium* which came from Macedonia was certainly Linnæus's *Rhodiola rosea* figured as such by Parkinson in his *Theatrum Botanicum*, after Lobel. 'It grows,' he says, 'in the very raggiest places on the mountains of 'Pangle and Ingleborough.' Soon after the discovery of the Canaries this name was transferred to *Convolvulus scoparius*, and afterwards to several American plants. It is called in the Islands Leña Noël, a corruption of Lignum aloes, and though now in little request, large quantities of it were formerly exported and the plant nearly extirpated."

The latest information on the subject is probably contained in Piesse's *The Art of Perfumery* (1879) p. 188, as follows:—

"When rose-wood, the lignum of the *Convolvulus scoparius*, is distilled, a sweet-smelling oil is procured resembling in some slight degree the fragrance of the rose, and hence its name. At one time, that is, prior to the cultivation of the rose-leaf geranium, the distillates from rose-wood and from the root of the *Genista canariensis* (Canary rose-wood) were principally drawn for the adulteration of real otto of roses; but as the geranium oil answers so much better, the oil of rhodium has fallen into disuse, hence its comparative scarcity in the market at the present day, though our grandfathers knew it well. One cwt. of wood yields about three ounces of oil.

"Ground rose-wood is valuable as a basis in the manufacture of sachet powders for perfuming the wardrobe."

D. M.

CCCXI.—CACAO-GROWING IN GRENADA.

(*Theobroma Cacao*, L.)

Cacao-growing is the staple industry of the interesting island of Grenada, and its prosperity during many years, when the other islands in the West Indies were in a depressed condition, was mainly due to the successful cultivation of Cacao trees. The maintenance of this industry is therefore a matter of great local concern. The present Governor-in-Chief of the Windward Islands, Sir Walter Hely-Hutchinson, K.C.M.G., has fully realised this fact, and he has been most strenuous in his efforts to assist cultivation, and to encourage everything calculated to improve the productiveness of the cacao estates.

The Botanical Station established at Grenada has also been brought into a vigorous state of efficiency, and it is now one of the most useful of any. This institution issues regularly a *Bulletin of Miscellaneous Information*, and in a recent number there are discussed several interesting points connected with the cultivation of Cacao trees gathered from the experience of a proprietor who has been more than ordinarily successful in producing large crops from a small area.

After referring to the little attention hitherto paid in the island generally to draining, manuring, and pruning on Cacao estates, Mr. G. W. Smith, the intelligent curator of the Grenada Botanical Station, proceeds as follows:—

"It is pleasant to notice one of the few instances in our island of a Cacao estate where, as the result of a careful system of draining and manuring, the proprietor gets from only twelve acres of Cacao a return equal to what many others receive from three times that quantity. I refer to Good Hope Estate in this island, owned by the Rev. G. W. Branch. On the advice of his Excellency Sir Walter Hely-Hutchinson, I called one morning on the proprietor, and was most courteously shown over the whole plantation. Both Mr. Branch and his son, Mr. George Branch, most willingly afforded me all the information in their power. Wishing to be as clear as possible, I shall endeavour to adhere as closely as I can to Mr. Branch's replies to my questions concerning the working of his estate.

"'I have been owner of the property for over 20 years. Good Hope contains 22 acres—eight acres of this are in canes and pasture. I estimate that the buildings, yard, and entrance occupy another two acres, so that my extent of Cacao cultivation cannot be much over 12 acres.

I purchased the place for about 100*l.*; at that time it had a few neglected Cacao trees here and there. Many people ridiculed my attempt to grow Cacao there, as the land was considered by most persons as almost valueless for that purpose. However, be that as it may, I could easily borrow 2,000*l.* to-day on its security if I wished to do so. My soil is rather poor for Cacao when compared with many other places; as you will see, in many places there is a bed of "tuff" not far from the surface, and you know, when the tap root of a Cacao tree touches this, there is an end of the whole matter.'

" 'How, then, do you account for the flourishing state of your trees, when, to judge from their size, the tap roots must long since have come into contact with this layer of "tuff"?'

" 'My Cacao trees have no need to drive their tap roots very deep, as I will show you when we are going through the orchard. The Cacao tree is naturally a deep rooter, but if it can meet with its nourishment near to the surface it will most undoubtedly develop its feeding spongioles wherever that nourishment is, and that is what happens in the case of my trees.'

" 'Please explain how you do this?'

" 'Willingly. My Cacao orchards are, as you observe, on the slope of a hill. Skirting the sides, therefore, among the trees, I have roads cut by simply digging down the slope to a level. These roads are sufficiently wide to admit the passage of a light donkey cart, and as they wind along the hillside in a corkscrew fashion you will understand how they serve a two-fold capacity. First, they act as roads proper, and, secondly, they act as drains, since a small canal always skirts the upper edge for the whole of their length. Thus I have my Cacao field drained at regular intervals, and, in addition, my donkey cart can carry manure to any part of my estate'

" 'How do you apply your manure?'

" 'Very simply; I just have the cart filled, and the driver upsets it at regular distances over the lower edge of these roads. I then go round as I can find time and bury this in. I likewise collect all leaves and bush from time to time, and bury these also. You will now see the effects of my system. Look down on the ground; what you are walking on is not pure earth. Take up a handful of it! You will notice that it is a dense mass of fine rootlets or spongioles! These have been called into being from the amount of nourishing material which they find here ready for them, and have no need to go deep in search of food.

" 'My system has converted the trees into surface feeders, and provided I keep them supplied with food I can fairly be said to have them well under control. Now, without manure the case is different; the tree has to push its tap-root deeper and deeper every year in search of food; often it strikes "tuff" or "clay," then death ensues. Even when this does not happen, it stands to reason that a tree with a single tap-root supplied with a few scanty and half-starved side rootlets, is in a poor way when compared with my healthy and vigorous trees which have an abundance of young roots all eagerly sucking up the plant food around them. The good effect of this is easily seen when comparing the returns I get with those of neighbouring planters.'

" 'What do you average as a return from your 12 acres of Cacao cultivation?'

" 'About 87 bags per annum. This would represent a trifle over seven bags to the acre.'

" 'The old trees which you found on the place 22 years ago must be very old by this time; do they still bear vigorously?'

" 'Yes, quite as well as the young ones, and they seem good for many years yet, thanks to my manure system.'

" 'What do you consider to be a good yield per tree in pods per annum?'

" 'It would be difficult for me to answer this, and, indeed, I have never kept a record; my trees practically never stop bearing, but my son counted 205 ripe pods on one of the trees besides green fruit and flowers; as you can see most of them have each several dozen ripe fruit, green fruit, and flowers on them at the same time, so that my crop may be said to be continuous.'

" 'Do you purpose extending your cultivation?'

" 'No; the remaining portion of my land is too much swept by prevailing winds to be of any value for Cacao; besides, I find that it pays me better to keep a portion in cane cultivation or some other fodder, not for the profit to be derived from sugar, but because it enables me to feed my stock; without this I could get no manure, and without manure I could get no Cacao. I look upon my stock, therefore, as part of my working capital, but people here seem entirely to forget this. I very often hear people speaking of the hard work they are having to get their plantation "covered in" as they call it, but if they knew what I know, they would find it more to their interest to keep one-fifth of their plantation in pasture lands, and fields of fodder plants, and to keep several head of stock to fertilise the other four-fifths.'

" 'What system do you adopt in storing your manure?'

" 'The old Barbados system, which I have found to work so well. I have all my animals kept in a pen, a portion of which is covered to afford protection in heavy weather. In this pen they stay nearly all the time that they are not in use. Their excrement is consequently collected in one place. I regularly cover this over with cut bush and litter, and at intervals I spread a layer of mould over it, and re-cover with litter. The result is, that at the end of a few months I have a mass five feet thick of the richest fertilising material that I know of and one that for our generous soil needs little assistance from chemical manures. In addition to this I use a large quantity of sheep manure, which I collect in a similar manner from my sheep farm at Point Saline.'

" 'Do you ever transplant your trees?'

" 'Often; and here, again, the beneficial effects of my system becomes apparent. I take up large trees with pods on them. There is no danger, not being deep feeders they give little trouble. When a gap occurs through the death of a tree I fill it up as soon as possible.'

" 'What do you do in the way of pruning?'

" 'I go through regularly and often, and break off all young shoots, and cut out any dead wood. You will see that my trees are perfectly clean of vines and lichens. A tree can't be healthy that has the pores of its bark stopped with roots of parasitical plants.'

" 'What is your opinion about shade?'

" 'I find in my locality that shade is beneficial in the growing stage, but is inimical when the tree commences bearing, at least heavy shade is. This holds good with even the "Criollo" Cacao, of which, as you see, I have a large number. With me this is one of the hardiest varieties, and bears profusely. My trees have crossed with each other, and now I have a great number of varieties shading off one into the other.'

" 'Do you use any care in selecting seed?'

" ' At first I was anxious to get my land planted up, so raised whatever seed I could get. Now I select and replace a bad variety with a good one whenever opportunity offers.'

" ' Do you grow other products with your young Cacao ?'

" ' Always; such crops as yams, tannias, cassava, and canes come well with young Cacao, and, in my opinion, rather do it good than otherwise, besides yielding catch crops of considerable value.'

" ' What process do you adopt in picking and curing. Do you separate the different varieties before sweating ?'

" ' With a small cultivation like mine it would be difficult to get a sufficient quantity of Criollo or any other variety at any one time to set up separate sweating boxes. I see the advantages of it, and regret that I cannot do so. My last account sales, however, are very satisfactory, and show a receipt of 72*s*. per cwt., which, taking all things into consideration, is very fair indeed. The process of curing is that generally pursued in Grenada, and needs no special explanation.' "

CCCXII.—GAMBIER IN BRITISH NORTH BORNEO.

A full account of the Gambier plant and the preparation of commercial Gambier, used for tanning purposes, was given in the *Kew Bulletin*, 1889, pp. 247–53. Since that time an attempt has been made to establish the cultivation of Gambier to British North Borneo. Information respecting the progress of the plantations in that part of the world is given in the *Kew Bulletin*, 1893, pp. 76 and 243. In the following correspondence an account is given of the first samples of Gambier received in this country from British North Borneo:—

THE BRITISH NORTH BORNEO COMPANY to ROYAL GARDENS, KEW.

15, Leadenhall Street, E.C.,
2nd February, 1893.

DEAR SIR,

I HAVE much pleasure in forwarding for your information copy of a report on our first specimen of Gambier from British North Borneo.

I observed that you printed some information as to our Experimental Gambier Garden, in the October number of the *Kew Bulletin*, and it is possible you may think it worth while to follow it up with this analysis.

Yours faithfully,
(Signed) WILLIAM M. CROCKER,
Manager.

W. T. Thiselton-Dyer, Esq., C.M.G.,
Royal Gardens, Kew.

[Enclosure.]

4, Fenchurch Avenue,
27th January, 1893.

DEAR SIR,

WE beg to advise you that we have had your sample of cubes analysed by Messrs. G. H. Ogston & Moore, and we are happy to inform you that, in spite of your sample being very mouldy and dirty by improper packing, the result of the test is eminently satisfactory.

In its present moist condition it shows 19·86 per cent. of tannin, but when properly dried and prepared as we should expect it to be delivered when shipped in the ordinary way, the test shows as much as 27·85 of tannin.

To show the importance and value of this result we have obtained from the above gentlemen a further analysis upon a fair sample of No. 1

Rhio Cubes; such is at present selling on this market at 30*s*. per cwt., and the following is the result, viz. :—

1st Test (wet).

	No. 1 Borneo Sample.	No. 1 Rhio Sample.
Tannin - - -	19·86 per cent.	20·00 per cent.
Moisture - -	18·70 „	13·92 „
	2nd Test (dried).	
Tannin - - -	27·85 per cent.	23·23 per cent.

which proves conclusively that on the ground of strength the Borneo sample is all that could be desired.

The objection to your sample is that in point of colour and general make up it is only suitable for shipment as ordinary " block," the value of which is from 19*l.* to 19*l.* 10*s*. per ton. If, however, you can produce pale cubes equal to the samples herewith the value would be much higher, as the following will show—

	£	£ *s*.
No. 1 sample block, value - - - -	19	19 10
„ 2 „ cubes „ - - -	31	32 0
„ 3 „ „ dark, value - - -	30	31 0

Bale Gambier is always pressed packed in double mats or gunnies, and should weigh from 2 to 2½ or even 3 cwt. each. Cubes should be well dried before shipment in order to prevent being " caked " or " blocky " on arrival, and are packed in bags weighing 1½ cwt. to 1¾ cwt. per bag.

The present rate of freight from Singapore to London is 22*s*. 6*d*. per 20 cwt. for block, 20*s*. per 10 cwt. for cubes.

There would be no difficulty in selling any quantity of the above all the year round.

We are, &c.
(Signed) HUTTENBACH & Co.

MR. H. WALKER to ROYAL GARDENS, KEW.

MY DEAR SIR, Sandakan, 21st April 1893.

I ENCLOSE report and analysis of Gambier raised in the Government Experimental Garden in Sandakan, which I am sure will be of much interest to you.

I took charge of the garden on the 3rd October, 1891, after my return to North Borneo, when 200 Gambier plants and 100 pepper cuttings had just been planted ; by the 25th October I had 990 Gambier plants out, and by the 8th December I increased the number to 3,253 and 587 pepper plants.

On the 4th October 1892, I decided to cut the first plantings, and we commenced boiling some time before the 2nd November and continued into December, and obtained five piculs of Gambier, but the colour was spoilt by the new iron boilers and by the smoke in my rather limited boiling-house. Consequently I had to ship it as Block Gambier.

The first sample was taken without my knowledge by an energetic friend, who gave me a copy of the analysis. The second report is on my sample parcel. The garden has now been taken over by a Chinaman, who is increasing it. He will cut over the whole clearing in May, and expects to get from 15 to 20 piculs. The plants I cut are now well-grown, and ready to cut again.

Up to the present only Chinese have taken up the cultivation of Gambier, but I can confidently assert that Europeans will do it better and get a higher price. What the trade wants is an assurance of quality and a sufficient quantity of a similar quality. I think it would be well to sell it per unit of Tannin, as Cinchona bark is sold. With a guarantee as to moisture, &c., and if copper pans and properly constructed drying-houses be used, the colour would (need) never vary.

The pepper plants are doing well. I am glad to tell you our *Coffea liberica* is doing very well. About 330 acres were planted by Europeans last year, and I believe a similar acreage will be this year. The reports all round are very favourable, and 12 months plants are now blossoming. Our climate, with its well-divided rainfall, seems particularly well suited to Liberian Coffee, and I never saw anything like it in Ceylon for vigour of growth or size of stem.

Cocoa is doing well here, and has a remarkable stem, but it is only since my return in 1891 that any plantings of coffee, &c. (of any size) have been made by Europeans, so that we do not figure on the markets. That we shall do so I have no doubt; indeed, I expect this will be a great coffee country. The latest reports from the tobacco estates are all favourable.

I am, &c.
(Signed) HENRY WALKER.

[Enclosure.]

Singapore, 25th March, 1893.

Messrs. Huttenbach Brothers & Co.'s report on 17 small bags pressed into 4 bales Block Gambier, marked B. N. B. D. C. L. ¼ London weighing Piculs 4·78, cwts. 5, qrs. 2, lbs. 2, shipped per S.S. "Pelamon" on 25th March :—

"The quality, we are pleased to say, is pronounced by local buyers "to be good, and not inferior in any way to Singapore Gambier, and "we have been offered for this parcel $7 per picul, while the market "price was only $6·60."

"However, the higher price is explained by the unusual dryness of "the goods, which of course enhances its value."

In another letter to Mr. Pryer, Messrs. Huttenbach Brothers & Co. say "the Gambier you sent is, if compared with the Singapore Gambier. "a little too dark coloured and too dry, but you will no doubt be able "to improve the next production in these respects."

CCCXIII.—WEICHER'S FIBRE EXTRACTING MACHINE.

This fibre extracting machine is constructed by J. J. Weicher, 108, Liberty Street, New York. It is now on trial in this country under Mr. Weicher's supervision at the Carlton Works, Printing House Yard. Hackney Road, London, N.E. The chief interest at the present moment attached to fibre machines is based on their capability to clean leaves of the Sisal Hemp plant so largely planted at the Bahamas and elsewhere. This brief report is therefore almost entirely confined to the treatment of leaves of this sort.

Recently, accompanied by Sir Alfred Moloney, Governor of British Honduras, I accepted an invitation to see the Weicher machine at work on Agave leaves obtained from the Riviera. The leaves were those of *Agave americana.* They had been cut about a fortnight, and hence they were not in the best possible condition for being experimented upon.

The Machine.—The machine consists of a drum fitted with beaters, and a feeding table mounted on an iron frame about 14½ feet long and 2½ feet wide. The whole structure is of iron, fitted with beaters composed of a mixture of copper, aluminium and iron attached to the drum where it comes in contact with the juice of the leaves. The general principle of the machine is similar to the "Gratte" in use in Mauritius, and the "Raspador" of Yucatan. The leaves, as in these machines, are presented endwise, and are cleaned by the beaters attached to the drum. About one half of each leaf is cleaned at one time. It is necessary to change the position of the leaf before the other half can be cleaned. There is, however, no reverse action, and in this respect the Weicher machine possesses an advantage over other machines of the same type.

The Feed Table.—The feed table consists of an endless band composed of flat iron laths fastened across two iron chains. The band is fitted with iron clamps for holding the leaves in position and presenting them to the beaters in such a position that at first about one half of their length is cleaned. After this the leaf is carried continuously back on the underside of the band, and brought out so that it can be seized by the operator and its position changed. When it is next presented to the beaters, the uncleaned part is treated and the whole of the fibre is then carried out and removed from the machine. The feed table is therefore automatic, and it will carry at one time about four or five leaves. These may be any length up to about eight feet, and the quickness of the cleaning depends very much upon the activity and aptness of the operators.

Serving the Machine.—For regular working a man and two boys are required. The man and one boy attend to the feeding and the changing of the leaves, while the other boy takes out the cleaned fibre and hangs it up to dry.

The Trial.—The machine was worked recently at intervals for about an hour. It readily cleaned Agave leaves of various sizes, some only half an inch thick and others between two and three inches thick. There is an arrangement of levers to allow for yielding in case of very thick leaves, and the machine was not clogged or stopped during any portion of the trial. This is an important consideration. The quality of the fibre produced was on the whole good. There was but little waste, and none of the strands was damaged or broken. The samples cleaned are now at Kew. Nothing has been done to them since they left the machine.

Washing the Fibre.—Where there is an abundant supply of fresh water, an arrangement could be made whereby the fibre might be washed while passing under the beaters. This, however, is not an essential part of the cleaning. It may be adopted or not according to local circumstances.

Particulars of the Machine.—The following particulars were obtained from Mr. Weicher. The total weight is 3,100 pounds (avoirdupois). The space occupied by the machine with feed table extended is 14½ feet long by 2½ feet wide. The power required is 10-horse power giving 500 revolutions per minute. The inventor has worked the machine in Yucatan for a period extending over nearly three months. One machine is still in Yucatan.

Yield of Fibre.—Mr. Weicher claims it will treat 10 to 12 tons of green leaves in a day of 10 hours. Allowing the leaves to yield 3 per cent. of fibre (in a prepared dry condition), this would be at the rate of 672 pounds per day as the lowest return, with a possible return (at 4 per cent.) of 896 pounds per day. As far as could be judged from the recent trial these returns are not improbable. It is, however, impossible to offer a definite opinion on the subject. The actual capacity of the machine can only be determined by continuous working on a Sisal hemp plantation, and with operators who have become thoroughly accustomed to it. In a Report on the Sisal hemp industry of Yucatan, prepared for the Government of the Bahamas by Captain E. Jerome Stuart, [*Kew Bulletin*, 1892,* p. 275], it is stated that the Weicher machine "requires 12 horse-power engine and the services of "three men. Capacity, 2,500 lbs. dry fibre per day of 10 hours." Mr. Weicher judiciously disclaims all responsibility for the capacity here given. He prefers to indicate it by saying that the machine will treat at the rate of 10 to 12 tons of green leaves per day. The actual yield in dry fibre will therefore depend upon the quality of the leaves. Mr. Weicher hopes to obtain as high as 5 per cent. of dry fibre from good leaves, and he thus estimates the out-turn per day of 10 hours at 1,120 to 1,340 lbs. These figures, it is needless to add, are given entirely on his authority. For comparison from actual working it may be mentioned that the Yucatan Raspador (with two men) acting on leaves of Sisal hemp will clean about 400 pounds of dry fibre per day. On the other hand, the Mauritius machine (also with two men) acting on leaves of the Green Aloe (*Furcræa gigantea*) will turn out only about 214 pounds of dry fibre per day. The difference in these returns may be due to the different qualities of the leaves, but it is evident that, so far, neither of these machines working on a commercial scale is able to turn out more than 400 pounds of dry fibre per day.

The conjectural figures given by Mr. Weicher require therefore to be received with due reserve until the performances of the machine have been fully tested.

Summary.—I may add that I have seen most fibre machines that have been brought forward and tested during the last 12 years. I am not yet in a position to say that any machine has fulfilled all the conditions necessary in cleaning Sisal hemp fibre. The whole of the Mauritius hemp (from *Furcræa gigantea*) exported from that island is cleaned by the Gratte, locally made and costing about 30*l.* [*Kew Bulletin*, 1890, p. 98]. This has to be fed with one or two leaves at a time, and there is considerable waste. There is also some risk to the workpeople, who have to hold the leaves in their hands while they are being cleaned. The Yucatan fibre is chiefly, if not entirely, cleaned by the rough contrivance known as the Raspador, also locally made [*Kew Bulletin*, 1892, p. 37, with woodcut]. The working of this is slow and wasteful, but with very cheap labour the industry is apparently very remunerative when prices are high. There is probably little or no inducement, owing to cheap labour, to introduce improvements in fibre cleaning in Yucatan. In the Bahamas the circumstances are entirely different, and a satisfactory machine is indispensable. The various machines that have hitherto sought to supplant the Gratte and Raspador, such as the "Death machine," the "Barraclough machine," and others, have all turned out better qualities of fibre, it is true, but the total yield has been small and disappointing. In fact, taking into account the great efforts made to introduce and popularise these machines, their extended use on a commercial scale has made little or no progress of late years. The Weicber machine possesses distinct merit, and it is more promising than any (so far as I have observed) with an automatic feed table. It may be said against it that it is somewhat heavy and intricate, and its price (not yet fixed) must be higher than either the Gratte or Raspador. It deserves, however, to be tried under suitable circumstances, and those interested in the fibre industry of the Bahamas, for instance, cannot do better than carefully test it on the spot. The inventor would then have an opportunity of showing its capabilities in the presence of an unlimited supply of leaves. It is impossible to do more in this country than form an approximate idea of its merits. It may be added that it is claimed for the machine that it will clean the leaves of Bow-string hemp (*Sansevieria*), Banana (*Musa sapientum*), and possibly also pine-apple and Ramie. None of these, unfortunately, were available at the recent trial.

D. M.

CCCXIV.—MISCELLANEOUS NOTES.

Retirement of Dr. Cooke.—On the removal of the Economico-botanical collections of the India Museum to Kew in 1880, the services of Dr. Cooke, who had hitherto had charge of them, were also transferred. As stated in the Kew Report for that year (p. 62) he took charge of the collections of Thallophytes in the Herbarium of the Royal Gardens. Dr. Cooke, after the death of the Rev. M. J. Berkeley, was the leading authority in Mycology in the country. The Kew collections of Fungi were already probably the largest in existence ; to those were added, by purchase, the private herbarium of Dr. Cooke himself. Besides incorporating the considerable accumulations, he re-arranged and brought the whole into excellent order. Having reached the age of 65, Dr. Cooke retired at the close of last year from the public service. In consideration of his services at Kew, the Secretary of State for India in Council was pleased to make a small addition to his pension. Dr. Cooke's services to the study of Mycology in this country hardly need a record. They are sufficiently evidenced by his " Handbook of the British Fungi " (1871), his " Illustrations of British Fungi," 8 vols., and by " Grevillea," a quarterly record of Cryptogamic Botany, of which 20 volumes (1873–92) have been published under Dr. Cooke's editorship.

Principal Assistant (Cryptogams).—The vacancy created by Dr. Cooke's retirement, has been filled by the appointment, in May of the present year, of Mr. G. Massee, with a somewhat larger scope of duties. In 1871–73 Mr. Massee travelled in South America under the advice of the well-known botanical traveller, Spruce, who was for many years employed by the Government of India in the task of obtaining seeds and plants of *Cinchona*. Under Spruce's influence, Mr. Massee has devoted himself ever since to botanical studies and investigations, and has now become an acknowledged authority in Cryptogamic Botany. He has published many works and papers connected with fungology. Amongst these may be mentioned :—A Monograph of the *Thelephoreæ*, published in the Journal of the Linnean Society; a Monograph of the *Gastromycetes* in the "Annals of Botany"; a monograph of the *Myxogastres*; and "British Fungus-Flora" (two volumes have appeared).

Acidanthera æquinoctialis, *Baker.*—Through Mr. Scott Elliot, Kew has received full specimens, with corms for cultivation, of this plant collected on the top of Sugar-loaf mountain, Sierra Leone, where Mr. Scott Elliot found it on his recent expedition as botanist to the Anglo-French Delimitation Commission. It was only known previously by a sketch of the inflorescence and flowers made by Dean Herbert, now in the Lindley Library, a copy of which was made several years ago by Mrs. Thiselton Dyer for the Kew collection of drawings. The corm is large and globose, with tunics of parallel fibres. The plant reaches a height of 4 feet, and the stem bears a large number of strongly-veined ensiform leaves, the lowest of which is a foot and a half long, and nearly an inch broad. The tube of the perianth is 5 or 6 inches long, the longest that is known in the whole order *Irideæ*. The species much resembles the Abyssinian *A. unicolor* and *A. bicolor* of Hochstetter, but is much larger in size. The locality where the plant was seen by Mr. Scott Elliot is 3,000 feet above sea-level. The whole collection brought home contains altogether 1,500 species.

Celtis australis.—The Earl of Ducie, F.R.S., has recently presented to the Museum some samples of whip-handles made of the wood of the European nettle tree, the *micocoulier* of the French (*Celtis australis*, L.). This tree is closely allied to the common elms, and is distinguished from them by having, instead of a membranous fruit, a hard fleshy drupe like a small cherry. The wood, when fully grown, is very hard and even grained, and is used for furniture. The branches are elastic and supple, and adapted for making hay forks and whip-handles. The specimens now presented to the Museum are peculiarly twisted. By cutting the branches along their length into four strips, and twisting these in the form of a cable, the strength and elasticity of the handle are increased. These whip-handles are generally used in France, and as they are chiefly made at Perpignan, they pass under the name of *Perpignans*.

Malayan Plants.—Dr. G. King, F.R.S., has sent from Calcutta a collection of between two and three hundred new or rare Malayan plants, and a set of two hundred and seventy specimens of the late Father Scortechini's Perak ferns. These ferns were worked out by Colonel Beddome, and published in the *Journal of Botany* in 1887. Mr. Charles Curtis, Assistant Superintendent, Forest Department, Penang, who is an excellent collector, has also forwarded a further set of 220 species of Malayan plants.

Karakoram Expedition.—Mr. W. M. Conway has presented the dried plants collected on his recent expedition to the Karakoram glaciers, in the Western Himalayas. They will shortly be worked out.

Persia.—Dr. Stapf, assistant for India in the Herbarium, has presented type specimens of about seventy species of plants collected by Buhse in Central and Northern Persia, and described by Boissier and Buhse.

Asia Minor.—A collection of three hundred species made by Sintenis in the district of Kastamuni, or Castambul, Asia Minor, has been purchased for the Herbarium.

Japan.—Through Dr. Kingo Miyabe, Kew has received from the Agricultural College of Sapporo, Japan, the first part of a set of the plants of the Island of Yeso. It contains 237 species, and includes the orders *Ranunculaceæ* to *Rosaceæ.* And through Professor Matsumura Jinzo, Director of the Botanic Garden, Imperial University, Tokio, the Herbarium has been enriched by a collection of some 1,350 species, including many not previously represented at Kew. This collection is valuable, apart from its numerical extent, inasmuch as it contains authentic specimens of novelties published by Professor M. Jinzo himself.

Tropical Africa.—From the expedition undertaken by Sir Gilbert Carter, K.C.M.G., Governor of Lagos, into the interior of that Colony and Protectorate, Kew has received two consignments of dried plants gathered by Dr. Rowland, the medical officer to the expedition. In all there are about 400 species, in excellent condition, and many of them of great interest. Mr. Millen, the Curator of the Botanical Station at Lagos, has also sent a small collection. Further Lieut. Charles S. Smith, R.N., Consul at Zanzibar, engaged on the Anglo-German Demarcation Commission, has forwarded a parcel of about 50 species, chiefly from Kilimanjaro.

South Africa.—From South Africa the Herbarium has received the twelfth and fourteenth centuries of Bolus and MacOwan's "Herbarium Normale Austro-Africanum," and Mr. Medley Wood, of Natal, has presented a number of novelties, including a very remarkable new *Sterculia*, which will be figured in the *Icones Plantarum.*

America.—Kew has purchased a set of Mr. C. G. Pringle's Mexican Plants, collected in 1892, and also the first three centuries of Mr. L. D. Reed's Virginian plants. Both of these gentlemen are excellent collectors, and Mr. Pringle's Mexican plants include novelties from the apparently inexhaustible Mexican flora. Dr. A. Engler, the Director of the Berlin Botanic Garden, has presented a parcel of about 100 species of Brazilian *Melastomaceæ*, many of them authenticated types of new species.

Australasia.—From time to time Sir F. von Mueller, K.C.M.G., has forwarded specimens of various novelties described by himself, including a number from New Guinea. Mr. W. Colenso, F.R.S., has presented specimens of about 200 New Zealand cellular cryptogams; and Mr. D. Petrie, F.L.S., a small but very interesting collection of flowering plants from the same country, several of them new species discovered and described by the donor.

Margaret Meen's "Exotic Plants from the Royal Gardens, Kew."—During many years it has been sought to add to the Kew Library a copy of this book, not so much on account of its scientific value as the fact of its being a record of plants that flowered at Kew towards the end of the last century. It is only within the last few weeks, however, that the work has been secured. It is a large folio, dedicated to Queen Charlotte. Like many other ambitious projects it soon collapsed. The intention was to publish two numbers annually, each containing four plates; and the price was sixteen shillings each for the coloured and twelve for the uncoloured. The first part is dated 1790, and contains figures of *Strelitzia Reginæ; Plumbago rosea*, *Cypripedium album*, and *Solandra grandiflora*. They are all lettered "M. Meen pinxt." and two of them "Prestel sculpt." and dated 1790. Number 2 has also a printed title page, but the plates in the Kew copy are proofs before lettering, and are probably by a different artist. *Ixora coccinea*, *Erica grandiflora*, *Lobelia surinamensis* and *Fuchsia coccinea* (true) are the plants represented. So far as our researches go these two numbers were all that was published, if indeed the second was really published; for Pritzel records only one, and he gives the dimensions as 19 by 15 inches; whereas the copy at Kew is 24½ by 19 inches. Bound with the foregoing in a cardboard cover, is a fine coloured plate of *Hæmanthus multiflorus*, "from Sierra Leone, recovered to European gardens " after having been lost near two centuries." "Drawn and engraved by " F. P. Nodder, Botanic Painter to Her Majesty, and published by him, May 1st, 1795." Nodder was the artist and publisher of an octavo work of four thin volumes, entitled "Flora Rustica," which appeared between 1792 and 1795. It contains 144 plates, and the descriptive letterpress was written by Thomas Martyn, then Professor of Botany at Cambridge.

Bulbs from Asia Minor.—Mr. E. Whittall, a merchant of Smyrna, and an ardent lover of plants, has considerably enriched the Kew collection of bulbous plants. He is collecting systematically, and the results promise to be very successful. Already several new things contributed to the herbarium have come to light amongst them *Galanthus Icarisiæ*, *Tulipa concinna*, and *Fritillaria Whittallii*.

Botanic Gardens, Brisbane.—The disastrous floods that took place in Queensland in February last appear to have inflicted great injury to the Botanic Gardens at Brisbane. These gardens adjoin Government House and indeed form a part of the same domain occupying a peninsula projecting into the Brisbane River. They were recently described in the *Australian Handbook* "as laid out with great taste; they abound " with tropical and sub-tropical trees and shrubs, and may be considered " one of the principal 'lions' of Brisbane." The untoward results of the late floods may be gathered from an extract from a letter received from Mr. Philip MacMahon, the Curator of the Gardens, dated the 28th March 1893:—You will regret to learn that these gardens were partially destroyed by two floods which followed each other at an interval of a fortnight on the 5th and 19th ult. A large new residence recently built for me was utterly destroyed, and all my books, &c., completely swept away. The gardens over a large portion of their area were covered by a deposit of mud and sand, in some cases two feet deep, and many thousands of shrubs were destroyed; many trees have sustained, I fear, permanent injury. All seeds and specimens as well as all my office records having been destroyed, it will be a great help to me in the reconstruction of the gardens if you could send me any seeds of plants not indigenous to these colonies. I am specially anxious to secure Chinese and Japanese shrubs, and flowering trees from any parts of the world.

New Liliaceæ from Tropical Africa.—In Engler's *Jahrbücher*, vol. XV., pp. 467–479, is a paper by Dr. Engler and Mr. J. G. Baker on the new Liliaceæ discovered by recent German collectors in Tropical Africa. It includes an *Iphigenia*, a *Bulbine* with flat leaves, an *Anthericum* of the sub-genus *Phalangium*, five species of *Chlorophytum*, one *Eriospermum* an *Aloe*, four *Albucæ*, one *Urginea*, two *Drimiæ*, five *Scillæ* of the sub-genus *Ledebouria*, and six new *Dracænæ*, one of which is figured. This latter, which is named *D. Braunii* after its discoverer, has been brought from the Cameroons to the Berlin Botanic Garden, where it flowered in August 1891. It has very short flowering stems, with only a single pair of leaves, overtopped by the much longer leafy sterile stems. The new *Aloe* (*A. venenosa*, Engler) was found by Dr. Pogge on the Kassai, one of the feeders of the Congo in the very centre of the continent, and is used as an arrow poison.

Botanical Station, Dominica: — The following interesting particulars respecting the work carried on at the Botanical Station, Dominica (in the Leeward Islands), have been communicated to Kew by Mr. Joseph Jones, the Curator:—Our work is prospering in this island. Everything is done to make the Station as attractive as possible, and on Sundays and holidays we have a large number of visitors. That it is useful to the planters is shown by the number of plants sent out during the past year, which reached the number of 16,486. I am acquainted with all the leading planters of the island and frequently forward information by letter. Owing to pressure of work on the station I have not been able to visit all those who have wished me to do so, as Dominica is a large island, in some parts almost inaccessible, and to visit those in the north means a somewhat lengthy absence from the station. The planters here are favourable to the station and consider the progress made very satisfactory, on the allowance of money. Some advocate an increase of the grant that it may be brought up to a high state of efficiency in a short time. There is no doubt our work is prospering and will continue to prosper. At the present time I am very busy. A small grant of money has been made to lay out the Recreation Ground and make it suitable for cricket. This I am carrying out as quickly as possible. To level and fill up the depressions requires about 500 tons of earth and the work will extend over two months. I am also called upon to lay out the grounds at the new Quarantine station and furnish the ornamental plants required. I have also to superintend the public gardens in town, the Government House grounds and furnish what plants are required at Government House. The nurseries have been recently enlarged by the addition of two new sheds. I have a large quantity of Blue Mountain, Mocha, and Liberian coffee for sale, also a good stock of cloves, and am trying to work up a large stock of nutmegs. Of peppers, black, cubeb, and long I have a fair stock, and am trying to push them. Of cacao we have a good stock in bamboo pots. Colas also meet with a ready sale.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 79.] JULY. [1893.

CCCXV.—SUGAR-CANE DISEASE.

The following correspondence relates to a disease which has, within the last few years, made its appearance amongst the sugar-canes in the West Indies, and has caused some apprehension. Considerable controversy has arisen as to whether it is an independent disease, or one consequent on previous injury by insect borers. The question has been further complicated by the fact that the fungus at different periods of its life-history exhibits three different and distinct forms, leading to the supposition, erroneous as it turns out, that the sugar-cane may be affected by more than one parasitic fungus.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew,
April 5, 1893.

SIR,

I HAVE the honour to inform you that for some time past numerous communications have been addressed to this establishment, respecting a disease which has made its appearance in the West Indies amongst the sugar-canes.

2. The injuries which the canes suffer from the attacks of insects, popularly known as "borers," have long been known, and have been now pretty completely studied. A tolerably exhaustive account, embodying everything that is at present ascertained, by Mr. Blandford, will be found in the number of the *Kew Bulletin* for July and August of last year.

3. The disease which is now complained of is of a more insidious kind, and is due to the attacks of a minute fungus. Considerable discussion has arisen as to whether the mischief is produced by one fungus or by several, and further as to whether the attacks of the fungus precede, follow, or are concomitants of the injury inflicted by the borers.

4. Such material for investigation as has been hitherto sent to Kew from the several botanical establishments in the West Indies has been inadequate, and has only yielded ambiguous results. I, however, received a letter early this year, from Mr. John R. Bovell, Superintendent of the Botanical Station at Dodd's Reformatory, Barbados, from which I enclose an extract, advising me of the dispatch of a very complete series of diseased canes.

5. I entrusted these to Mr. George Massee, a well-known expert in mycology, who made a careful study of them in the Jodrell Laboratory at Kew. I enclose a copy of the preliminary report with which he has furnished me. This completely establishes that—

(i.) The disease is due to a fungus, a species of *Trichosphæria*; this, like many allied minute fungi, has the peculiarity of possessing more than one reproductive phase. These different phases have been mistaken for distinct fungi, but as a matter of fact they are not so, but are capable of reproducing one another.

(ii.) The *Trichosphæria* is evidently a very destructive parasite. It can effect a lodgment on the young leaves of the sugar-cane, but not on the mature ones. But it readily takes advantage of any wound, such as is produced by the removal of young shoots, or by the different kinds of "borers." It is this latter circumstance which has led the malady which the fungus produces to be regarded as having some connexion with the "borers."

6. No practical remedy can be suggested to check the progress of the disease, beyond the "cutting out" and the careful destruction by *burning* of every diseased cane.

7. I may be permitted to suggest that a copy of this letter should be communicated to the Government of Barbados, and to such other of the West Indian Colonies, interested in sugar production, as the Secretary of State may deem desirable.

8. I may add that Mr. Massee proposes to publish a detailed account of the *Trichosphæria*, which possesses many points of scientific interest, in the "Annals of Botany."

I am, &c.
(Signed) W. T. THISELTON-DYER.

The Hon. R. H. Meade, C.B.
Colonial Office,
Downing Street, S.W.

EXTRACT from LETTER from the SUPERINTENDENT, Botanical Station, Dodd's Reformatory, Barbados, dated February 11, 1893.

As the question of a fungus attacking canes which have not been first injured by the moth-borer is still a very debatable point with those over your way who take an interest in the matter, I am sending you by mail steamer to-day a box containing (1) canes which have been just attacked by the fungus, and in which no shot or moth-borers are present as yet, as far as I can see without cutting up the cane; (2) canes which have been attacked with the fungus a little longer and in which shot-borers have entered but no moth-borer; (3) canes with fungi, shot-borer and moth-borer; (4) canes killed by moth-borer only.

PRELIMINARY REPORT ON THE SUGAR-CANE DISEASE.

The abundant supply of living material, consisting of 18 large canes, illustrating every stage of the disease, sent to Kew for investigation by Mr. Bovell from Barbados, has enabled the vexed question as to the part played by fungi in connexion with the sugar-cane disease to be conclusively settled.

Each cane was accompanied by a description of the supposed cause of disease, as, killed by "shot-borer," "moth-borer," "fungus," and in some cases two or all the above were described as being present on the same cane.

Microscopic examination showed the presence of the fungus in every cane, but in some instances, owing to the absence of fruit, its presence could not be detected by the naked eye.

Only one fungus—an undescribed species of *Trichosphæria* was found on the canes. The idea entertained by some planters, that more than one fungus is connected with the disease, probably arises from the fact that the *Trichosphæria* has at least three distinct forms of fruit, very different in general appearance, and whose development depends on the relative vitality of the canes.

Further experiments showed that *fully developed* leaves and stems cannot be infected on an unbroken surface; nevertheless, when the surface is broken, infection is readily effected. A cane about 1½ in. diameter was inoculated by cutting a deep slit and introducing mycelium from a pure culture of the conidia; in 16 days the cane was split at this point, and the central portion was found to be coloured red for a distance of 3 in., and the mycelium had extended even beyond that distance; the microscope showed the presence of the dark olive conidia formed in tissues away from the light. Infection also readily takes place at points where lateral branches have been broken off.

Summary.—1. The experiments described above prove that the *young* leaves of the sugar-cane can be infected by the spores of *Trichosphæria* falling on an unbroken surface, and further, that the fungus acts as a true parasite, eventually killing the plant.

2. In older plants inoculation can only take place when the surface is wounded, but when an entrance through a wound is once effected the fungus acts as a destructive parasite.

3. The frequent presence of both fungus and moth-borer or shot-borer in the same cane is explained by the above statement.

Stage I.—Conidial condition, for the rapid reproduction of the species; appearing on the surface of wounded parts as a very delicate, dark-coloured velvety mass, or when old and very abundant, penetrating the internal tissue of the cane and producing a black charred appearance, due to the numerous chains of large olive-brown conidia.

Stage II.—Melanconium form, bursting through the cuticle of old canes in the form of minute black filaments. Often following the ravages of the "moth-borer" or "shot-borer" in dying or dead canes.

Stage III.—The ascigerous form. Minute, black, hairy perithecia, present only on dead and more or less decayed portions of cane.

The conidia from Stage I., obtained from a pure culture, were placed on the unbroken surface of *very young* leaves of lateral shoots of a healthy sugar-cane plant growing in the Lily House, Kew Gardens; in five days the infected areas showed deep red blotches, and in 14 days the conidial form of the fungus was perfectly developed, the mycelium in the meantime having passed into the shoot and adjoining leaves. Soon afterwards the young infected shoots decayed and dropped off, microscopic examination showing that the mycelium had passed into the tissues of the parent stem.

Assuming the insect to first pierce the cane, the spores of the fungus would find a suitable place for development in the wound; hence the presence of one parasite prepares the way for another, and the combined action of the two soon ends in the destruction of the plant. Nevertheless the fungus is not entirely dependent on the previous presence of the insect, but readily finds entrance at broken points, and can alone kill the cane.

Protective Measures.—The conidia of the fungus will not germinate, neither will the mycelium grow in a 1 per cent. solution of cupric sulphate; but spraying with the ordinary Bordeaux solution is in all prebability not practicable, other than in the case of an experimental plot, and would certainly have no beneficial effect on an infected area.

Remembering that the mycelium of the fungus extends, as a rule, far beyond the range indicated by its presence to the naked eye in a given cane; and further, that almost every cane—judging from the material examined—attacked by the "moth-borer" or "shot-borer" is also infested with the fungus, it would be unwise to use apparently sound portions of such canes for propagation.

It was observed in those canes killed by the fungus alone that the disease was oldest and most mature near to the root, and this suggests the question, Was the cane, even if taken from a healthy stock, inoculated with the fungus spores on the cut and exposed surface of the portion used for propagation? As a preventive against this possible cause of inoculation, the cut surfaces might be painted with a solution of Bordeaux mixture immediately on being cut, and repeated at intervals.

It has been observed that the fungus causing the sugar-cane disease develops readily on the young leaves of the bamboo, the same may prove to be true of other members of the *Gramineæ*, hence a careful search should be made for such possible nurse-plants, as the spores would be carried for a considerable distance by the wind.

Finally, all diseased canes should be burnt, and not allowed to remain to rot, during which condition they are simply producing fresh material for the inoculation of other plants.

Previous to the receipt of the material reported on above, several consignments of diseased sugar-cane had been received at Kew from Mr. Hart from Trinidad, caused by the same species of fungus; but as the material was either dry or preserved in spirit no cultures or inoculations could be made.

April 4, 1893. G. M.

CCCXVI.—ALDABRA ISLANDS.

The Aldabra Islands are a group of coral islets, about 30,000 acres in extent, to the north-west of Madagascar, in about 9° 30′ S. lat. They are only about 200 feet high; the shore is fringed with mangroves, and the whole surface is said to be covered with forest. They have not till the present time been botanically investigated.

From a natural history point of view they are interesting as the home of a gigantic tortoise (*Testudo elephantina*), in dimensions comparable with that of the Galapagos (*Testudo elephantopus*).

The following correspondence gives some recent information about this little known group.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

Downing Street,
29th July 1892.

SIR,

I AM directed by Lord Knutsford to transmit to you for your perusal a despatch from the Administrator of the Seychelles, in which that officer gives an account of a recent visit to the Aldabra Islands.

I am to request that this despatch, which is sent in original, may be returned.

I am, &c.
(Signed) EDWARD FAIRFIELD.

The Director,
Royal Gardens, Kew.

Government House, Seychelles,
13th June 1892.

SIR,

I HAVE the honour to report that Her Majesty's ship "Redbreast," Lieutenant-Commander Preedy, arrived here on the 12th of May, having directions from Rear Admiral Kennedy, Commander-in-Chief on the East India Station, to visit the Island of Aldabra and afford me an opportunity of also visiting these outlying islands of this Government if I desired to do so.

2. I decided, though so recently returned from Europe, to take advantage of the offer, and I embarked accordingly on the morning of the 20th May. After a remarkably unpleasant passage, owing to strong winds and severe rolling of the vessel, I arrived at Aldabra on the 23rd of May at eleven o'clock in the morning. The "Redbreast" entered the main channel of Aldabra and moored there. A current of at least six knots runs there at every rise and fall of the tide, and only steam vessels could make way against such a current.

3. Mr. James Spurs, to whom the islands are leased, resides, we discovered subsequently, quite on the other side of the island; he came on board when the tide permitted in the afternoon and recommended the Commander to change anchorage, which was accordingly done the next afternoon, when we steamed out and anchored off the island and also the western channel in about 17 fathoms of water.

4. The following morning I went on shore to visit Mr. Spurs' establishment and observe some of the natural peculiarities of this extraordinarily formed island, which, except here and there, appears to be one mass of very ancient coral, which has been washed for so many centuries by the sea that all the softer portions have been washed out and the remainder is hard and ragged, and therefore is difficult to walk over. Curious to state, small trees, shrubs, and vines flourish over it, and in these inextricable places, which are of vast extent, do the enormous land tortoises find a genial and apparently prolific existence.

5. When Mr. Spurs first went to Aldabra he was of opinion there were very few of them left, but he now states that there cannot be less than 1,000 in all the island. I made him repeat this statement more than once, as I was sceptical about so large a number, but he assured me that a few hundred would not accurately describe their number.

6. The number of edible turtles which it is possible for Mr. Spurs to secure both at Aldabra and the three neighbouring islands of this group is far in excess of his capabilities of dealing with them. It would be no exaggeration to say that from 12,000 to 15,000 could be turned in one twelvemonth in Aldabra alone. As no steamers call at Aldabra and only a small schooner two or three times a year, which latter takes some time to get back to Mahé, the majority of such turtle as are shipped invariably die. To be properly conveyed they must have shade and sea water.

7. The market price of a turtle weighing from 300 to 450 pounds in Mahé is from Rs. 18 to Rs. 30 according to the supply on hand, but it is a food that to many persons is simply obnoxious. The popular fallacy that turtle must be excellent because well-made turtle soup is so generally appreciated, is soon dispelled by those who partake of it in any other form, whilst the excellence of good soup is only produced by a variety of expensive ingredients.

Rock oysters are procurable in great quantities, and those of which I partook appeared to be very good.

8. Mr. Spurs complained also of the absence of rain at Aldabra, which is very detrimental to the crops he endeavours to raise on a certain portion of the island where such soil as exists is rich.

9. I did not visit Cosmoledo, the nearest of the other islands, but he informs me that there are large numbers of goats upon it, of which I saw several specimens which had been taken to Aldabra.

The Orchilla weed that grows upon the mangrove and other stunted trees about the place Mr. Spurs obtains in England 45*l*. a ton for, but the supply is not large.

10. I took with me to Aldabra a new flagstaff to replace the old one Mr. Spurs had been using, and also made him a present of some new flags. Mr. Spurs informs me he has upon five or six occasions observed steamers passing within a distance of seven miles off this island.

11. There are several small detached islets of coral in Aldabra which, by process of time, sea, and tide, have become exactly like an enormous mushroom in appearance; some of them are probably 50 feet in diameter.

Altogether the island is a very curious one, and I was glad of the opportunity to have visited it.

I have, &c.
His Excellency (Signed) T. RISELY GRIFFITH,
H. E. H. Jerningham, C.M.G., Administrator.
Administering the Government of Mauritius.

Subsequently to the visit of the Administrator the Aldabra islands were visited by Dr. W. L. Abbott, an American gentleman of independent means, whom Mr. Risely Griffith was good enough to interest in behalf of Kew. The account given by him of the islands adds something to that given in the despatch of the Administrator. The collections unfortunately miscarried and have not as yet reached Kew.

DR. W. L. ABBOTT to ROYAL GARDENS, KEW.

Mahé, Seychelles,
March 15, 1893.

DEAR SIR,

YOUR letter reached me a few weeks ago on my return from Aldabra. Am afraid my collection of plants does not amount to much. I am not a botanist, being altogether interested in Ornithology and Mammology, and have scarcely ever collected plants before my Aldabra trip. I do not know if the plants were properly prepared. On my arrival in Aldabra, in September, there were a few plants in flower and fruit; many did not have leaves. Then a period of two months occurred, during which no rain fell, and vegetation of every sort dried up. During December there was a heavy rainfall; nearly every plant put forth fresh leaves and bloomed. Was much bothered by mould and ants. The latter ate up nearly everything as fast as gathered. However I obtained specimens of *most* of the native plants. The papers are somewhat mixed up, specimens of fruit and flowers being frequently in separate papers; however they can be picked out without much difficulty. The only trees now in Aldabra are Casuarinas and Mangroves, the latter some of the largest I have ever seen, sometimes 18 inches in diameter and 50 to 60 feet high. Formerly "Porché" and "Rose-wood" grew to considerable size, as shown by the decaying stumps; now only small ones exist.

On the other hand *small* plants are remarkably scarce. Almost the entire vegetation consists of shrubs of from 3 to 7 feet in height. As soil is extremely scanty, and the droughts and heat excessive, this may account for the paucity of small plants. Almost the whole island, or rather islands, consist of bare fossil coral, with an extremely jagged and rugged surface, honeycombed with great pits and crevices into which the sea water finds its way at high tide. There are no orchids. The most conspicuous plant is a sort of Aloe (?), of which there are three *living* specimens in the box. There does not seem to be more than 35 indigenous plants, and most are represented in the collection which I sent you.

I visited many of the islands in these seas, Providence, Assumption, and Glorioso, but made no collections of plants, as my stay was too short. Glorioso seemed to be comparatively rich in species.

Hoping that the Aldabra box will reach you and prove of some interest,

I remain, &c.
Mr. Thiselton-Dyer, (Signed) W. L. ABBOTT.
Kew.

CCCXVII.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS V.

41. **Sterculia Murex,** *Hemsl.* [Sterculiaceæ]; foliis longe petiolatis digitatim 7-foliolatis, foliolis papyraceis vel subcoriaceis subsessilibus lanceolatis subacutis basi cuneatis utrinque venis elevatis minute reticulatis molliter stellato pubescentibus, venis primariis lateralibus numerosis supra medium plus minus distincte bifurcatis et inter se anastomosantibus, floribus . . . . fructus carpellis maximis brevissime stipitatis apice longe rostratis apertis fere hemisphæricis extus tota longe spinosis simul papillosis, papillis ferrugineo-stellato-pubescentibus, spinis validis rigidis curvatis inæquilongis vetustis saltem subobtusis, seminibus ut videtur 10 compresso-ovoideis vel ellipticis nigris, hilo parvo, testa crustacea, albumine ceroso.

Habitat.—Transvaal, South Africa, *Mr. J. Medley Wood*, 160 (1892) carpel and seed; 4710 (1893) two leaves.

Petiolus communis circiter semipedalis. *Foliola* 5–7-pollicaria. *Carpellum* apertum circiter 6 poll. diametro, spinis ¼–1½ poll. longis instructum. *Semina* circiter pollicaria.

This species is remarkable for its exceedingly large carpels, which are densely armed with long spines interspersed with shorter ones. Mr. Wood has promised to try to obtain flowers; meanwhile we do not hesitate to publish it from the foliage and fruit alone.

42. **Smithia (Kotschya) Carsoni**, *Baker* [Leguminosæ-Hedysareæ]; fruticosa, caulibus virgatis dense pubescentibus, foliis brevissime petiolatis, stipulis persistentibus coriaceis ovatis vel lanceolatis haud calcaratis, foliolis 8–10 jugis dimidiato-oblongis rigide coriaceis glabris mucronatis, racemis brevissimis 1–2 floris, pedicellis brevissimis, bracteolis lanceolatis hispidis, calyce hispido magno labio superiore oblanceolato-oblongo, inferiore profunde tripartito segmentis angustis infimo concavo, vexillo orbiculari quam calyx breviore, alis angustis, carinâ leviter incurvata, ovario pauciovulato dense pubescente, stylo longissimo.

Habitat.—Central Africa, on the plateau over Lake Tanganyika, *Carson*.

Folia 2–3 poll. longa, *foliolis* 5–6 lin. longis. *Calyx* 8–9 lin. longus. *Vexillum* 6 lin. longum, *alæ* et *carina* paulo breviores.

Allied to *S. Pfundii*, Schweinf., of Kordofan, and *S. Chamæcrista*, Benth., of Madagascar.

43. **Dizygotheca leptophylla**, *Hemsl.* [Araliaceæ]; glabra, caule simplici inermi, foliis radiato-digitatis longe petiolatis juvenilibus et ramulorum lateralium sterilium ab adultis valde dissimilis multo minoribus (unde nomen specificum "leptophyllum") foliolis sæpius 5–7 fere linearibus obsolete paucidenticulatis, petiolo petiolulisque gracillimis, foliis plantæ adultæ seu floriferæ amplissimis, foliolis 7–11 subcoriaceis longe petiolulatis oblongis obtusis basi rotundatis vel interdum subcuneatis integris insigniter undulatis subtus vix pallidioribus, costa subtus elevata, venis primariis lateralibus numerosis sat distinctis, petiolo maculato crasso fere tereti basi incrassato apice disciformi cum foliolis angulum rectum formantibus, floribus mediocribus verticillatim umbellato-paniculatis, umbellulis 5–10 floris, pedicellis gracilibus, bracteis bracteolisque per anthesin omnino carentibus, calyce truncato, petalis angustis vix acutis reflexis intus carinatis, staminibus 5, filamentis fere filiformibus quam petalis vix longioribus, antheris magnis 4-locularibus, ovario 10-loculare.—"*Sciadophyllum leptophyllum*," spec. cult. in herb. Kew; *Aralia leptophylla*, Veitch in Proc. R. Hort. Soc. Lond. 1862, p. 318; J. Makoy, Prix Cour. 1862, p. 5; Gard. Chron. xvii., 1882, p. 227.

Habitat.—Unknown, though it has been in cultivation upwards of 30 years.

Caulis plantæ hodie in horto Kewensi cultæ 6-pedalis, pollicem crassus. *Folia* juvenilia minora visa cum petiolo 8-pollicaria, petiolo foliola fere æquanti; *foliola* 4–5 lineas lata. *Folia* maxima plantæ Kewensis cum petiolo 26-pollicaria, lamina 20 poll. diametro; *petiolus* 16 poll. longus, 3 lineas crassus; *foliolum* maximum 9 poll. longum et 3 poll. latum; *petiolulum* 2-pollicare. *Inflorescentiæ* pars siccata in herb. Kew 10 poll. longa et lata; *pedicelli* circiter 5 lineas longi. *Flores* 3–4 lineas diametro. *Fructus* non visus.

Mr. R. I. Lynch, Curator of the University Botanic Garden, Cambridge, recently sent to Kew a flowering specimen of this old inhabitant of our gardens, with some remarks on the almost incredible diversity between the foliage of young plants and flowering plants; but having watched it through its various stages he could have no doubt about it. Looking through the herbarium I found a specimen that flowered at Kew previous to 1867. It is clearly a congener of the plant described by Mr. Brown (*Kew Bulletin*, 1892, p. 197), under the name of *Dizygotheca Nilssoni*, and also, most likely, a native of Polynesia.

5-5280 44. **Carpesium atkinsonianum**, *Hemsl.* [Compositæ-Inuloideæ]; humilis gracilis fere undique parce pubescens, caulibus simplicibus, foliis petiolatis membranaceis primum scaberulis lanceolatis v. inferioribus latioribus fere rotundatis acutis basi cuneatis minutissime remoteque calloso-denticulatis, capitulis parvis paucis pedunculatis foliis parvis (vel involucri bracteis foliaceis) sub capitula 1–3 vel interdum nullis, involucri bracteis pauciseriatis cito glabrescentibus coriaceis vel scarioso-coriaceis basi incrassatis oblongis apice rotundatis vel fere truncatis simul plus minusve irregulariter dentatis exterioribus gradatim brevioribus, floribus paucis, achæniis glabris angustissimis striatis breviter rostratis, rostro insigniter glutinoso-glandulifero, pappo nullo.

Habitat: Lofau mountains, Kwangtung, China, Mr. C. Ford, 317 (1892).

Caules 4–9 poll. alti. *Folia* maxima 3 poll. longa. *Capitula* 3-5 lineas diametro. *Achænia* circiter sesquilineam longa.

This plant is named after Dr. Atkinson, Superintendent of the Government Civil Hospital at Hongkong, a gentleman who has given Mr. C. Ford, the Superintendent of the Botanic Garden, all the aid he could in the botanical exploration of the neighbouring mainland.

45. **Calea (Eucalea) floribunda**, *Baker* [Compositæ-Helianthoideæ]; fruticosa, sarmentosa, ramulis parce pubescentibus, foliis petiolatis ovatis interdum cordatis obtusis crenatis subcoriaceis facie glabratis dorso pubescentibus venis exsculptis, capitulis paucifloris heterogamis radiatis perpluribus densissime corymbosis, pedunculis pubescentibus, involucro paucifloro infundibulari bracteis pauciseriatis imbricatis valde inæquilongis exterioribus parvis ovatis interioribus oblongis ciliatis, ligulis 2–3 patulis, pappi paleis paucis lanceolatis acuminatis inæqualibus

Habitat.—Central Brazil, in the province of Minas Geraes, *Glaziou*, 19,542.

Folia inferiora 3 poll. longa. *Involucrum* 3 lin. longum, 1½ lin. diam. *Pappus* 1 lin. longus.

Allied to *C. solidaginea* and *prunifolia*, H. B. K.

46. **Pedicularis flaccida**, *Prain* [Scrophularineæ]; adscendens glabra, caulibus gracilibus corymbosim ramosis, foliis ramisque 3–4-natim verticillatis radicalibus mox evanescentibus caulinis breve petiolatis ovatis pinnatifidis segmentis 5–6-jugis obtusis inciso-serratis, floribus verticillis 4-floris paucis remotisque dispositis, bracteis foliaceis calycem excedentibus, calycis glaberrimi parvi campanulati antice parum fissi 5-dentati segmentis omnibus oblongis integris tubo costato nec fisso, corollæ tubo sursum ampliato calycem 3-plo excedente basi infracto, labio 3-lobo lobis lateralibus ovatis medio orbiculato basi constricto 3-plo majoribus galea leviter arcuata tubo subcontinua apice subincurva erostri, staminibus ex adverso medii ovarii insertis filamentis omnibus glaberrimis, antheris contiguis muticis, ovario ovoideo stigmate exserto.

Habitat.—Western China, in the Mountains of Szechuen, *Pratt*, 471.

Nearly related to *P. verticillata*, L. and *P. refracta*, Maxim., differing from the former in having contiguous anthers, and a distinctly toothed calyx, and from the latter in having the calyx tube not costate between the ribs, the calyx teeth entire, and the anther cells muticous. From *P. verticillata* it also differs in foliage; from both it differs in habit, in having the calyx much smaller, and in having perfectly glabrous filaments.

47. **Euphorbia Sipolisii,** *N. E. Brown* [Euphorbiaceæ]; caulibus carnosis ramosis acute tetragonis articulatis aphyllis glabris, cymis sessilibus lateralibus terminalibusque paucifloris, involucro basi 1–3 bracteato campanulato glabro 5–6-lobo lobis subquadratis fimbriatis, glandulis transverse oblongis angulis vix productis, fructu longe pedicellato reflexo glabro subgloboso tricocco.

Habitat.—Brazil, *Glaziou.*

Rami 4 lin. diam. *Involucra* 2–2½ lin. diam.

This is a very distinct species belonging to the section *Euphorbium*, of which it makes the second at present discovered in Brazil. It was received in a collection of plants made chiefly in the province of Minas Geraes, and sent to Kew by Dr. A. Glaziou in 1892, but the specimen was unaccompanied by any precise locality. It is dedicated to the Abbé Michel Marie Sipolis, Director of the Seminary of Diamantina, who has rendered many services to science in general.

48. **Syringodea Flanagani,** *Baker* [Irideæ]; cormo parvo tunicis brunneis membranaceis, foliis 6–9 filiformibus glabris, perianthii tubo luteo cylindrico spathâ duplo longiore, segmentis pulchre rubro-purpureis exterioribus oblanceolatis interioribus oblanceolato-oblongis, staminibus limbo distincte brevioribus.

Habitat.—Cape Colony: province of Albany, on the summit of Gourlie Hill, near Kongha, alt. 2,400 feet, *Flanagan*, 720.

Cormus 3 lin. diam. *Folia* 1–2 poll. longa. *Spatha* 6–9 lin. longa. *Perianthii limbus* 4 lin. longus.

This interesting new species of the genus that represents *Crocus* at the Cape has recently been received from Professor McOwan.

49. **Kniphofia zombensis,** *Baker* [Liliaceæ]; foliis paucis ensiformibus pedalibus vel sesquipedalibus haud acuminatis erectis flaccidis marginibus incrassatis lævibus, pedunculo stricto subvalido foliis eminente, racemo denso oblongo, pedicellis brevissimis, bracteis magnis lanceolatis acuminatis scariosis niveis distincte brunneo-carinatis, perianthio subcylindrico vix policari e medio ad basin sensim angustato, lobis latis brevissimis, staminibus inclusis, stylo exserto.

Habitat.—Mount Zomba, Shiré highlands, *Buchanan*, 664.

Folia deorsum 6–9 lin. lata, sursum sensim attenuata. *Racemus* 3–4 poll. longus, bracteis inferioribus 5–6 lin. longis. *Perianthium* 2 lin. diametro.

A very distinct species with the general habit of *K. aloides*, but having only a few broad, comparatively short and flat leaves, different bracts and a differently shaped perianth.

50. **Kniphofia longistyla,** *Baker* [Liliaceæ]; caule basi incrassato, fibris radicalibus perpluribus tenuibus, foliis radicalibus pluribus linearibus sesquipedalibus marginibus lævibus, pedunculo foliis longiore, racemo denso oblongo, pedicellis brevissimis, bracteis oblongis, perianthio cylindrico pollicari lobis parvis ovatis obtusis, staminibus perianthio æquilongis, stylo longe exserto.

Habitat.—Shiré highlands, *Buchanan.*

Folia deorsum 3–4 lin. lata, sursum sensim attenuata. *Racemus* bipollicaris, bracteis inferioribus 3 lin. longis. *Perianthium* 1 lin. diam. *Stylus* 3–4 lin. exsertus.

Habit and foliage of *K. pumila* and *K. Tuckii*, but flowers very different.

CCCXVIII.—PARA RUBBER IN CEYLON.

As stated in the *Kew Report* for 1876, p. 8, Mr. H. A. Wickham, a resident on the Amazon, was commissioned by the India Office to collect seeds of *Hevea brasiliensis*. He arrived in England on June 14th with 70,000 seeds obtained on the Rio Tapajos, and on August 12th following, about 2,000 plants raised at Kew from these seeds were despatched to Ceylon in 38 Wardian cases. Ninety per cent. of the plants reached their destination in perfect condition. A further consignment of 100 plants was sent in 1877, making the total number of plants transmitted to Ceylon 2,119 (*Kew Report*, 1877, p. 15).

The following correspondence gives the first result of the experiment which affords anything like commercial data for deciding whether the cultivation of this staple would be a paying enterprise in the Old World :—

DR. TRIMEN to ROYAL GARDENS, KEW.

[Received February 6th, 1893.]

India-rubber (2 lb.) from *Hevea brasiliensis* grown in Heneratgoda Botanic Garden, Ceylon, in 1892.

The tree from which this was obtained is now 15 years old, and the stem has a circumference of 6 ft. 5 in. at a yard above the ground.

It has now been tapped three times, and has given the following yield :—

In 1888 it gave 1 lb. 11¾ oz.
„ 1890 „ 2 lb. 10 oz.
„ 1892 „ 2 lb. 13 oz.

Making a total of 7 lb. 2¾ oz. of dry rubber in five years.

The tree is in no respect the worse for this treatment; the rest in alternate years permitting the scars on the trunk to become completely healed.

(Signed) HENRY TRIMEN.

MESSRS. HECHT, LEVIS, & KAHN to ROYAL GARDENS, KEW.

21, Mincing Lane, London, E.C.
7th February, 1893.

DEAR SIR,

WE have received your yesterday's letter, and also the sample of Ceylon rubber which you have sent to us. The quality of this rubber is very good indeed, and the curing of the same seems to have been effected in the proper manner. This quality would be easily saleable, and we estimate its value to-day as being about 2*s*. 3*d*. to 2*s*. 6*d*. per lb., according to whether the rubber would be dry or damp. It would be easily saleable in *large quantities*.

We return the sample to you, according to your desire.

We remain, &c.
(Signed) HECHT, LEVIS, & KAHN.

John R. Jackson, Esq.,
Royal Gardens, Kew.

CCCXIX.—GOLD COAST BOTANICAL STATION.

The interesting Botanical Station established under the auspices of Sir W. Brandford Griffith, K.C.M.G., at Aburi on the Gold Coast has already been noticed (*Kew Bulletin*, 1891, p. 169; 1892, pp. 14 and 297).

In the present note, embracing communications received at Kew from the Secretary of State for the Colonies, only the indirect results of the Station are discussed. These have, however, so important a bearing upon the health and well-being of Europeans on the West Coast of Africa that they deserve to be more widely known.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 9th June, 1893.

I AM directed by the Secretary of State for the Colonies to transmit to you for your information, the enclosed copy of a despatch from the Gold Coast Colony regarding the excellent condition and beneficial effects of the Sanatarium at Aburi.

I am, &c.
(Signed) R. H. MEADE.

The Director, Royal Gardens, Kew.

Government House, Aburi Hills Station,
MY LORD, April 28, 1893.

ABOUT the middle of March, Dr. Easmon, the Acting Chief Medical Officer, whose health had become somewhat impaired by overwork, requested my permission to come to this Station to recruit. He remained for a fortnight, and on his return to Accra addressed a letter to the Colonial Secretary, copy of which I have the honour to transmit herewith, as it will afford your Lordship some idea of the salubrity of this Hill Station and of the change which has taken place at Aburi since 1890, with regard to which Dr. Easmon expresses himself in such rapturous terms.

2. Ten days after my return from England in February 1890, I came to this Station to reside for six weeks with the object of starting the new Botanical Station, having brought with me from Monrovia, where my steamer stopped, a dozen intelligent English-speaking Liberians who had been accustomed to the planting and treatment of coffee trees. I also employed about 30 men and utilised my Hausa escort, and in this way I had seven acres of land cleared of forest trees, and of the undergrowth of smaller ones and scrub, in three weeks, grubbing up the roots on a few acres and having them prepared for planting. The land originally cleared around the house was only one acre.

3. Mr. Crowther, the Curator, arrived on the 16th of March. On the 23rd I handed over the Station to him, and he commenced to clear the remaining 19 acres of land. Subsequently 16 acres were purchased. Mr. Crowther set to work to clear these, and at present most of the cleared ground has been planted with coffee trees, grown from seed imported from Liberia, which are growing with extraordinary luxuriance and vigour while many of them are already producing berries. Other portions are planted with a very superior description of coffee, plants of which were brought from Jamaica and Santa Cruz in the West Indies a great many years ago, the berries yielding a delicious beverage, and in cocoa, from beans procured from Trinidad and Fernando Po. Both the native Coffee and Cocoa are already bearing, and in this regard it is

worthy of remark in what a short time coffee and cocoa begin to give a return in this Colony. In two years and a half after planting many of the trees commence blossoming and in due season yield an abundance of produce. Part of the land is devoted to growing fruit and vegetables, and the cleared unused portions are being gradually planted up with coffee and cocoa, seedlings remaining in excess of the quantities grown for sale and unapplied for, although large quantities have been sold to the public. The Station is partly surrounded by 300 young cocoanut trees which are growing vigorously, and by about an equal number of the Royal Palm, (*Oreodoxa regia*) a magnificent tree, seeds of which were imported from the West Indies.

4. The result of clearing the land of all valueless or unimportant forest trees and of the undergrowth has been not only to increase the ventilation of the station, but to make it distinctly cooler and healthier, whilst affording, by the removal of obstructing trees, a view of the coast line from Pram Pram to the lagoon West of Accra, the buildings of which are visible without the aid of glasses, with which steamers can be seen when at anchor in the roadstead or passing on. The entire land of the station is well laid out and intersected by excellent pathways and roads, whilst the portion immediately surrounding the house presents the appearance of a well-kept English garden.

5. I speak from experience of what I have seen of officers when they have left Accra for Aburi, and on their return to headquarters, when I state there can be no doubt that an invalid or anyone in reduced health coming to Aburi and remaining for a few weeks picks up marvellously in health, and presents the appearance of a person fresh from England.

6. The repairs to the house have not yet been completed owing to the difficulty of getting native timber for the purpose in the neighbourhood, a difficulty which, I hope, will soon be overcome, as there is discomfort in occupying some of the rooms, the floors and ceilings of which require to be put in good order.

I have, &c.
(Signed) W. BRANDFORD GRIFFITH,
Governor.

The Most Honourable,
the Marquess of Ripon, K.G.

COPY of a LETTER from the ACTING CHIEF MEDICAL OFFICER to the COLONIAL SECRETARY, dated 3rd April 1893.

SIR,

I HAVE the honour to report, for the information of His Excellency the Governor, my return to Accra from the Sanatarium at Aburi at 5.30 a.m. this day after a fortnight's absence for the benefit of my health.

I think it is only fair to record my grateful experience of the improvement in my health induced by the change, and I do this all the more to emphasise the fact which several years ago I observed and reported, viz.: the very great usefulness of the Aburi Sanatarium. I have within the last 10 years sent several patients to this sanatarium, official and unofficial, and in almost every instance the benefit derived has been most satisfactory.

The Aburi of to-day, however, is quite a different place from the Aburi of 10 years ago. It was a dreary enough place for an invalid to find himself in, almost hemmed in by bush, and often without a companion to solace him. Now the telephone places the patient in communication with his medical adviser at Accra; he is received on his arrival at Aburi by the courteous and sympathetic curator, Mr. Crowther, whose healthy appearance and genial welcome suffice to re-assure him that improvement in his health will soon be accomplished, whilst on every side the eye feasts on the charms of a scientifically laid out and cultivated garden such as can be seen nowhere else in the Colony; here, a noble avenue of stately orange trees, the delicate aroma of whose blossoms perfumes the air; there, avenue of graceful spondias nodding their leaf-laden branches to the bracing breezes that sweep from over the Akim hills. These, intersected by floral walks and avenues of citrons and oranges, the interspaces thus formed being occupied, here with cacao plants, there with native coffee plants, and elsewhere with Liberian coffee trees; while just in front of the house, neatly arranged rows of beds are covered with flowers of all varieties and shades of colour. The whole thing is so different from what obtains in Accra: the great elevation above the sea, the soft, cool, refreshing breezes, the nights of profound sleep and rest. These are the claims of Aburi as a sanatarium, and only those who have suffered from the sleeplessness of the surf-bound coast towns can realise at its fullest worth the importance of the last of these.

The invalid furniture recently supplied is, indeed, a great boon to the invalids, and is money well spent. The crockery, cutlery, and kitchen utensils and table and bed linen require some attention.

I think I ought to add that during my visit there were at least six invalids resident in the Basal Mission Sanatarium, five Germans, and one an Englishman. And in the town there were several natives of Accra, some of them my private patients, who were recruiting their health at the station. In addition, three European and several native officials and many other private individuals went up for the Easter holidays, an event quite unprecedented in the annals of Aburi.

In conclusion, I beg to record my grateful appreciation of the unremitting and thoughtful kindness of Mr. Crowther to myself and the other invalids at the sanatarium.

I have, &c.
(Signed) J. FARRELL EASMON,
Acting Chief Medical Officer.

CCCXX.—HORTICULTURE IN BELGIUM.

With the permission of the First Commissioner of Her Majesty's Works and Public Buildings, the Curator of the Royal Gardens, Mr. George Nicholson, A.L.S., was sent to Belgium for the purpose of attending the Thirteenth International Quinquennial Horticultural Exhibition at Ghent (April 16–23) and of visiting the more important horticultural establishments. The following notes give his impressions of the present position of gardening enterprise in Belgium:—

Belgium is a great horticultural country, and Ghent itself one of the busiest and most important centres of gardening on the continent. Nurseries, many of them of very considerable extent, exist by the hundred in its immediate neighbourhood. Owing to various causes, cheap glass, cheap labour, &c., many plants are grown for trade purposes on an enormous scale and exported to other European countries at a less price than they could be grown by the persons who import them. Azaleas are a case in point. That splendid specimens of Azaleas can be grown in this country is evident enough to anyone familiar with our great flower shows, but that beautiful bushy market plants can be produced in the same time and at the same cost as those exported from Belgium is, I believe, impossible. The continental summer allows these to be planted out in beds in the open air, and causes the wood to be thoroughly ripened and the buds to set in a way which cannot obtain with us except in exceptionally favourable seasons. On the other hand, our moister cooler summers enable English gardeners to surpass their continental colleagues with such plants as *Nepenthes*, Ferns, Heaths, and many hard-wooded plants.

Fashion in horticulture changes in a somewhat arbitrary way, and no one can escape this conclusion by even reading the reports of the exhibitions of less than 20 years ago and those of to-day. Then new plants and collections were much valued, and nurserymen kept for sale large collections of stove and greenhouse plants, which now are hardly to be found outside a botanic garden. Even Camellias, which less than a generation ago were very extensively grown about Ghent, are now not to be seen in some establishments where once they were the principal stock in trade; apparently the difficulty in arranging the cut flowers and the impracticability of cutting largely from the plants is the cause of the disfavour into which they have fallen. New plants too, in the sense of collections of species, are almost ignored in many places, and instead enormous numbers of ornamental foliage and flowering plants, belonging sometimes to not more than a score of species, not unfrequently a much less number, are now to be seen.

The International Quinquennial Exhibition is the 13th of the series and the 159th flower show organised by the "La Société Royale d'Agriculture et de Botanique" of Ghent. The society was first formed in 1808, and its first exhibition was held in a room of a small inn in 1809 about 100 yards from the site of its present quarters; a reproduction of this first exhibition as regards the room, &c., and as far as possible the species and varieties of plants was one of the most interesting features of the Quinquennial of 1888.

From 1837 exhibitions were held in a large permanent building, but in 1878 temporary structures more vast each succeeding "quinquennial" were built in the grounds. This year one structure admirably built, designed by M. Ed. Pynaert covered a space of more than 2,500 square metres; and arrangements for heating were made so that, had the weather proved cold, the plants contained in it would have been perfectly safe.

Subsidies from the Belgian Government, the Province, the town of Ghent and the subscriptions of the members of the Society furnish the large sum of money necessary to carry out an exhibition on so vast a scale. No entry fees are paid by exhibitors, and the Society makes arrangements with the railway and steamship companies for low freight charges. This year the entries were more numerous than ever, some even were refused for want of space—and some groups of plants which otherwise would have been under cover were placed for effective masses in the open garden. The jury consisting of 184 members, belonging to 15 nationalities, including Russia, Brazil, and Japan, divided into sections had to judge about 660 classes.

The Great Hall, a glass-roofed structure, with an area of 2,200 square metres, was so arranged as to produce a wonderfully fine effect. Large palms, tree-ferns, &c. were massed irregularly round outer walls and at the foot of the double staircase leading to the upper rooms of the casino. A main curving walk went round the building in front of these tall banks of foliage. Eight masses of dwarfer growing plants were arranged in the centre of the hall with a broad central walk and shorter ones leading into the main arteries.

The palms were especially well-grown, large specimens in splendid health in small tubs and pots. Careful attention to watering, and especially in the application of liquid manure, enable the growers to produce beautiful specimens of great size, which can be moved about with comparative ease. Some years ago collections of palms were grown for sale by some of the principal Belgian nurserymen ; now house after house of a single species or of a very few of those best adapted for decorative work, are to be met with, and the rarer kinds of less value from a "furnishing" point of view have almost entirely disappeared. *Kentia*, *Phœnix*, *Cocos*, and *Livistona* are the genera now most frequently represented in nurseries, but in the exhibition a number of fine specimens of *Washingtonia* and *Erythea* (imported from the Riviera), *Thrinax*, *Sabal*, *Rhapis*, *Pritchardia*, *Seaforthia*, &c. were to be seen.

In the centre of the great hall, huge specimen Azaleas were so thickly covered with flowers as to hide the leaves. Although in shape the plants were extremely formal, they showed exceptional skill in cultivation. There must have been considerable trouble taken in "keeping back" plants which under any ordinary conditions in such a season as the present would have been quite out of flower before the exhibition opened. We heard of one exhibitor placing blocks of ice in his Azalea house in order to keep down the temperature. Careful shading—in some cases moving plants into dark sheds, &c.—was also resorted to. Some of the Aroids exhibited were exceptionally fine ; a grander lot of *Anthurium scherzerianum* than that exhibited by M. G. Warocqué was probably never before seen ; the specimens were very large, healthy, and with extraordinarily large inflorescences. The ornamental foliage Aroids were also well represented ; these plants are more widely grown as stove decorative plants in Belgium and other continental countries than in Britain. Ferns, with the exception of tree-ferns, which were well shown, were not remarkable ; much better groups as regards cultivation and variety are to be seen at any of the large London shows.

Cycads were good and attracted much attention, but they were decidedly inferior, for instance, to those in cultivation in the Palm House at Kew. Fine plants of Caladiums were exhibited in great variety by M. Louis Van Houtte.

The Norfolk Island Pine, *Araucaria excelsa*, and a number of garden varieties of it were exhibited in the most perfect condition ; in and around Ghent whole series of houses in many establishments are devoted to the cultivation of this conifer. It is one of the most popular plants for table and conservatory decoration.

In the Central Hall of the Rotunda were exhibited two very wonderful groups of orchids containing many rare choice and valuable varieties of well-known species, and not a few well-grown plants of rare species beautifully flowered. The two exhibitors were MM. J. Hye and G. Warocqué, both Belgian amateurs.

A collection, said to contain 228 distinct species, many of them uncommon, was exhibited by M. Alfred Van Imschoot ; amongst them was a *Vanilla* in fruit.

Both at the exhibition and in many of the nurseries visited, the English visitor could not help being struck by the health and vigour of Cattleyas, Odontoglossums, Miltonias, and other orchids. Whether the extreme vigour of the plants conduces to longevity (many orchids are short lived under cultivation) is a question which many would like to see definitely settled. As a rule a much higher temperature is maintained in the houses than is considered good for the same species under cultivation in English orchid houses.

Canvas is not used in Belgium as a shading material, but thin laths or bamboo strips wired together and drawn up or let down by means of rollers, as are the canvas blinds in England. As a consequence during sunlight the orchid leaves are barred transversely with bands of light and shade quite different from the more diffused light caused by canvas. I cannot but think that this may have something to do with the success which attends the cultivation of Cattleyas, Odontoglossums, &c. in Belgium.

No thrips or other insect pest infested any of the numerous sets of plants seen; on inquiry this was attributed to a layer of the midribs of tobacco leaves placed on the hot water pipes; fumigation was not resorted to.

In the class for New Plants Messrs. Sander & Co., St. Albans, exhibited *Dracæna sanderiana*, a distinct plant with elegant yellow and green leaves, from the Cameroon Mountains; *D. godseffiana* from the Gold Coast, remarkable for its prettily spotted foliage and an ally of *D. surculosa*; *Ludovia crenifolia*, a Carludovica-like plant from Tropical America; *Alocasia watsoniana* from Sumatra; *Alsophila atrovirens*, a beautiful tree fern from South America, and *Strobilanthes dyerianus*, an East Indian Acanthad with brilliant purple-red leaves and erect spikes of blue flowers. L'Horticulture Internationale, Brussels (M. Linden). showed *Eulophiella Elizabethæ* from Madagascar, a new genus of orchids, with large beautiful flowers; *Tradescantia Reginæ* and *T. superba*, beautiful tropical ornamental-leaved species; *Smilax argyræa*, a small elegant-leaved climber mottled with silvery grey; *Hæmanthus Lindeni*, a handsome plant with a head of brilliant crimson flowers not unlike *H. multiflorus*, and *Begonia Lansbergiæ*, a noble plant with large emerald green hairy leaves.

The Hippeastrums shown by Messrs. James Veitch & Sons, Chelsea, were remarkably fine, much better than those of any other exhibitor. The *Nepenthes* exhibited by M. Alex. Dallière of Ghent were much inferior to the plants we are accustomed to see in English gardens. In spite of the season—all hyacinths grown in the open air had long been past—one room was resplendent with remarkably fine pot hyacinths contributed by several Dutch growers.

The new Bertolonias exhibited by Van Houtte attracted much attention; it is impossible to describe the delicacy as well as the brilliancy of their foliage.

Saintpaulia ionantha, a gesneraceous plant with a rosette of radical leaves and short scapes, bearing deep violet blue, yellow-anthered flowers, was one of the prettiest as well as one of the most interesting new plants exhibited. Seeds of it were sent home by the German officer (in whose honour it has been named) from the mountains of Eastern Tropical Africa. In general aspect the plant resembles *Ramondia pyrenaica*.

In British gardens, Bromeliads have not yet acquired the position to which they are entitled as ornamental plants; many of them are very handsome and their strangely marbled leaves and brilliantly-coloured inflorescences, which often last a long time, make them popular on the continent for decorative purposes. Many thousands of one species alone—beautifully grown plants—were seen in the Royal Gardens at Laeken, where Mr. Knight uses them with great effect. At the exhibition were to be seen many fine hybrids; some of the best were those shown by M. Duval of Versailles, under the names of *Vriesea tessellata*, *splendens*, and its varieties *major* and *minor*. Other very fine Bromeliads were exhibited by the Botanic Garden at Liège—for so many years famous for its collections of this family of plants,—by MM. Jacob Makoy & Co., and by M. J. Moens.

Crotons I have seen much better shown in England.

In the large annexe beautiful colour effects were produced by masses of *Azalea mollis*, Rhododendrons shown in fine variety by M. Pynaert, *Azalea indica, Clivia miniata*, vars., &c. One of the most successful efforts in the way of plant cultivation I have ever seen were the oranges *Citrus sinensis*) from M. Gulinck and M. Alexis Dallière; the plants were fine bushes and pyramids, 2 to 3 feet high, laden with well coloured fruits.

Kalmia latifolia, dense, compact bushes covered with flowers, were exhibited in quantity; a more elegant pot plant could scarcely be imagined than this as grown at Ghent.

The Sweet Bay (*Laurus nobilis*) is cultivated in some establishments near Ghent and elsewhere in Belgium by the acre. They are grown in tubs as round-headed bushes on stems or as pyramids, and as specimens, showing great skill on the part of the grower, they leave nothing to be desired. During winter the plants must be housed; they require so long a time to attain a marketable size and so much care to bring them to such a state of perfection that they are much too valuable to risk outside during winter.

Choisya ternata was well grown and flowered. Some specimens had hemispherical heads, on stems 2 feet high, covered with blossoms. *Cytisus scoparius*, var. *andreanus*, was also exhibited, grown in a similar way.

Diervilla (or *Weigela*), Eva Ratke, is a handsome variety with deep red flowers; it was finely exhibited by M. Pynaert, and will doubtless be cultivated by all who love hardy shrubs.

At Laeken a bronzy yellow tea rose, William Morley, is grown under glass for cutting, and is preferred to Maréchal Niel, as it is not so liable to canker as that variety. Standard hybrid perpetual roses and dwarf moss roses were largely grown in pots and well done. In a bed in one of the large conservatories a fine mass of *Strelitzia Reginæ* was in flower; it was planted out; the temperature in winter was kept up to 15°–16° Centigrade (say 60° Fahrenheit). Amongst other striking plants planted out at Laeken are Clavijas, Bromeliads, *Chamærops stauracantha*—a remarkably fine specimen,—*Kentia Lindeni*, and other rare palms. Brunfelsias in fine flower produced beautiful effects as bushes planted out.

Large plants of *Vanda tricolor*, &c., grown elsewhere and brought into the large warm conservatory to flower, were models of good cultivation. A number of small bushes—not a foot high, in six-inch pots—of *Medinilla magnifica* bore as many as half a dozen fine inflorescences; these must have been raised from large cuttings taken from old plants after growth had been made and bloom buds more or less formed. In any case the Medinillas were a triumph of gardening skill.

One of the great features in the spring months at Laeken is the great extent of corridor connecting the different groups of houses with the palace and with each other. There are about 1,200 yards of corridor, and in mid April it was a blaze of flower. Tropæolums, ivy-leaved and zonal Pelargoniums, *Abutilon megapotamicum* (A. vexillarium), which was also used with considerable effect as a basket plant, Passion flowers, Heliotropes, Jasmines, the true *Acacia riceana, Rhodochiton volubile, Dolichos*, Bignonias, and other plants being trained up the side and roofs.

Columbines were largely grown as pot plants for decorative furnishing, and remarkably fine they were.

G. N.

CCCXXI.—ECONOMIC PLANTS OF SIERRA LEONE.

A report on the botany and geology of the district of Sierra Leone traversed by the Anglo-French Boundary Commission in 1892 has lately been issued by the Colonial Office. It is prepared by Mr. G. F. Scott Elliot, F.L.S., the botanist to the Commission, with notes on the geology by Miss Catharine A. Raisin, B. Sc. of University College.

From the botanical portion of the report the following references to the economic plants of Sierra Leone are of interest. It may be remembered that an account of the fruit productions of Sierra Leone was given in the *Kew Bulletin*, 1888, p. 221:—

COFFEE.

Coffee was discovered wild at Sierra Leone so long ago as 1796 by Mr. A. Moore. At present there are two different species cultivated by the natives, and these require different treatment.

Coffea stenophylla.—The narrow-leaved "wild," "bush," or "native coffee," is sometimes found wild in the hills, and is more often cultivated by the natives than the Liberian. It grows very freely, and appears to yield quite as much as the Liberian, but it is somewhat longer in coming into bearing. Both the natives and French traders at Freetown say that it has a superior flavour, and prefer it to the Liberian. In fact, latterly, a certain amount has been exported to a wholesale French dealer, who is said to sell it at 4 francs 50 centimes a lb. as "best Mocha." Considering that it is worth in Freetown about 6*d*. a lb., this should be a fairly profitable trade, and a trial shipment should be made by the English merchants to find out exactly what the market value in Liverpool would be. The plant appears to thrive best on the higher hills about Sierra Leone, on gneissose or granitic soil, and can be grown from 500 to 2,000 feet. Probably it may be grown both above and below these limits.

Coffea liberica.—There is no doubt that the cultivation of this coffee is extremely profitable in the Sierra Leone district. There is one well established plantation, and bushes may constantly be seen in native enclosures. The Hon. S. Lewis was kind enough to show me over his plantation at Christiansville, which probably contains some 70,000 trees, and gave me every information with regard to it. It was commenced in 1883, and of course was in its initial stages both extremely expensive and disappointing. Now, however, Mr. Lewis thinks he has advanced beyond the experimental stage, and he certainly seems to be gaining the reward which his enterprise and perseverance so well deserve.

RUBBER.

The amount of rubber available from the rubber-vines of West Africa (species of *Landolphia*) depends on the amount of original forest, and this is not large in the district we traversed. On the other hand, there are enormous areas from which rubber could be obtained, provided the district was freed from the never-ceasing native wars and slave-raiding expeditions. Thus the country about Laya and Kofiu mountain, as well as the Benna country, along the edge of which we passed, is full of forests, and contains much rubber which would, if the roads to Kambia were safe, pass down the Scarcies River. The Fula country, lying back from the north-west corner of the English sphere of influence, is also said to be full of rubber, which would most probably come down the same way. Along the 10th degree of north latitude the country is in many places broken and mountainous, and the deeper and narrower valleys are full of dense forest (too far from a market for timber to be exported), but from which the rubber could be profitably withdrawn. There is also in all probability an enormous supply in the almost uninhabited Koronko district, and in the magnificent woody valleys about Bafodeya and other parts of the Limba country, on the Upper Rokelle, and especially in the back country of Sherboro. I should think it probable that with roads made absolutely safe the supply of rubber from the colony might be doubled or even quadrupled in amount, but with the development of lawlessness and the constant native wars everywhere, but little is to be expected after the next few years, when the sources readily reached from the coast have been drained of their supplies. It must also be remembered that the supply is one which is likely to be exhausted with increase of population, and ought not to be reckoned upon for more than a few years, supposing the country *were* rendered safe.

OIL PALM.

The export of palm oil and kernels forms by far the largest part of the West African Export Trade. The following figures are given by the *Sierra Leone Gazette*:—

——	1888.	1889.	1890.
	£	£	£
Palm oil - - -	12,285	11,379	13,599
Palm kernels - -	97,177	105,963	107,827

The tree is more abundant further down the West African coast, and appears to prefer alluvial, often marshy, ground near the sea. It particularly seems to thrive on the rich soil of the mangrove accumulations. There are large numbers of these trees in the Mahela district, where a factory once existed, and there are also a considerable number up the Scarcies river, and in the lower part of the Limba district. It grows also on low sandstone or gneissose hills, but probably does not produce so much in such places as on the low lying rich alluvials. The palm is propagated from the offshoots that appear at its base, and these are said to begin to bear in the second or fifth year, and are in full bearing about the 10th to 15th year; they continue producing for 60 years.

A single tree yields from 1 to 3 gallons of palm oil. This would be a profit of from 2*s*. to 6*s*. a tree per annum. The palms require no care, and are not, apparently, attacked by any injurious insects.

The preparation of the oil is of a very rough and makeshift character; the fruits are thrown into a tank and left till decomposition begins; they are then boiled, and afterwards pounded in a mortar. Probably 25 per cent. of the oil is lost in preparation.

PINE APPLE.

This plant is almost wild in many places, and seems to grow wherever placed without the least attention. We found it common about Sierra Leone, and again along the Scarcies, and even as far up country as Falaba. It grows as a rule on the laterite and ironpan hills, but it is said that if planted on good alluvium very large fruits can be obtained with a little attention. This must, however, be neither too stiff, so as to hold water, nor of too sandy and dry a character. They should be planted out from off-shoots at from three to four feet distances at the beginning of the rains, and they ripen in 14 to 20 months. Development from seed takes 10 to 12 years. The price of the present small and inferior kind sold at Sierra Leone varies from ½*d.* to 1½*d.* each. This fruit is one of the most important if an export trade is ever formed.

BAMBOO.

The mountains about the upper waters of the Scarcies rivers and also at Falaba, produce an abundance of bamboos [probably species of *Oxytenanthera*] usually about 20 feet high and 3 inches diameter. These are, as a rule, hollow stemmed, but are of considerable strength and used locally for many purposes. The quantity available is enormous, but probably being nearly 300 miles from the coast it is impossible to have them brought to market. They grow on mountain sides and usually kill out every other plant, and they seem to prefer dry rocky ground. The only specimen in flower which I saw is too poor for determination, but it is almost certainly a new species of Bambusa.

COTTON SEED.

No attempt has been made to utilise the enormous amount of cotton seed which must be annually thrown away at Sierra Leone. The supply would be enormous if the seeds could be profitably exported, as the plant is grown in almost every village.

CCCXXII.—NEW ORCHIDS: DECADE 6.

51. **Pleurothallis puberula,** *Rolfe;* caulibus teretibus elongatis, foliis elliptico-oblongis obtusis brevissime bidentatis basi attenuatis, spatha conduplicata carinata submembranacea, racemis elongatis multifloris, floribus subdistichis, bracteis tubulosis truncatis, sepalis lineari-lanceolatis acutis puberulis, petalis obovato-oblongis truncatis v. retusis, labello recurvo subpandurato-oblongo apice obtuso subrevoluto medio bicarinato, columna alata.

HAB.—Not recorded.

Caules 6 poll. longi, vel fortasse interdum ultra. *Folia* 6–7 poll. longa, 2¼–2½ poll. lata; *petiolus* 1 poll longus. *Spatha* 9 lin. longa. *Racemi* 3–5 poll. longi. *Bracteæ* ¾–1 lin. longæ. *Pedicelli* 2 lin. longi. *Sepala* 2½–3 lin. longa. *Petala* 1–1¼ lin. longa. *Labellum* ¾ lin. longum.

This species belongs to the section *Spathaceæ*, and is allied to the West Indian *P. univaginata*, Lindl., but its flowers are smaller and more densely arranged on the raceme. It was sent for determination by Mr. F. W. Moore, Keeper, Royal Botanic Garden, Glasnevin, in January 1892, and again early in the present year. The flowers are pale green with a little dull yellow at the base, and exhale a hawthorn-like fragrance. The upper half of each sepal is finely pubescent.

52. **Bulbophyllum spathaceum**, *Rolfe;* rhizomate repente radicante valido epseudobulboso, foliis petiolatis lineari-oblongis obtusis, scapis erectis brevibus basi spathaceis, racemis cylindraceis parvifloris multifloris, bracteis lanceolatis acuminatis, sepalo postico lanceolato-lineari subacuto lateralibus triangulo-lanceolatis acutis postico latioribus, petalis linearibus obtusis, labello recurvo integro lineari-oblongo obtuso subcarnoso, columna brevissima dentibus brevibus.

HAB.—Burma, Shan States.

Folia 3½ poll. longa, 1 poll. lata; *petiolus* 1 poll. longus. *Scapi* 4 lin. longi. *Bracteæ* 1½–2½ lin. longæ. *Pedicelli* 1–1½ lin. longi. *Sepala* 1½ lin. longa. *Petala* 1 lin. longa. *Labellum* 1 lin. longum.

This species was introduced by Messrs. Hugh Low & Co., of Clapton, and flowered with Mr. James O'Brien, of Harrow-on-the-Hill, Middlesex, in July 1892, when it was sent to Kew for determination. It is allied to *B. apodum*, Hook. f. "Flora of British India," v. p. 766, but has shorter leaves, and a much denser raceme, and much more slender membranaceous bracts. The flowers are light straw yellow, with a somewhat brighter lip. The base of the inflorescence is sheathed by spathaceous bracts, in allusion to which the name is given.

53. **Bulbophyllum viride**, *Rolfe;* rhizomate repente gracili, pseudobulbis ovoideis subcompressis monophyllis, foliis subsessilibus lineari-oblongis subobtusis, scapis gracilibus paucifloris foliis saltem duplo longioribus bracteis ovato-oblongis breviter acuminatis, sepalis subpatentibus lanceolato-ovatis acuminatis, petalis ellipticis minute apiculatis subconcavis, labello recurvo integro oblongo subobtuso ciliato subcarnoso infra medium canaliculato, columna brevi dentibus subulatis incurvis.

HAB.—W. Trop. Africa.

Pseudobulbi 2–4 lin. longi. *Folia* ½–1 poll. longa, 1½–3 lin. lata. *Scapi* 2–3½ poll. longi. *Bracteæ* 1 lin. longæ. *Sepala* 2½ lin. longa. *Petala* 1 lin. longa. *Labellum* 1½ lin. longum.

This small species was sent to Kew for determination by Philip Crowley, Esq., Waddon House, Croydon, in December 1890. A plant presented to the Kew collection has since flowered on two or three occasions. It is allied to *B. intertextum*, Lindl., from the same region. The flowers are wholly light green, except for the presence of a pair of small dull purple eye-like spots on the base of the lip, and a stain of the same colour on the face of the column.

54. **Eria albiflora**, *Rolfe;* pseudobulbis aggregatis ovoideis v. ovoideo-oblongis, foliis oblongo-lanceolatis acutis basi attenuatis, scapis gracilibus pubescentibus, racemis laxifloris, bracteis oblongo-lanceolatis acutis, sepalo postico lanceolato-oblongo subobtuso lateralibus obliquis semiovatis subacutis, petalis lanceolato-linearibus subobtusis, labello rhomboideo-suborbiculari subobtuso v. apiculato concavo membranaceo, columna brevissima.

HAB. S. India, Nilghiri Hills.

Pseudobulbi ½–¾ poll. longi. *Folia* 1–2½ poll. longa, 2–4½ lin. lata. *Scapi* 3–5 poll. longi. *Bracteæ* 1–2 lin. longæ. *Pedicelli* 2 lin. longi. *Sepala* et *petala* 1½ lin. longa. *Labellum* 1 lin. longum.

This plant was sent to Mr. J. O'Brien, of Harrow-on-the-Hill, Middlesex, with whom it flowered in June 1891, and again in August of the following year; and it has also flowered at Kew. It belongs to the section *Bryobium*, and may be placed next to *E. articulata*, Lindl. The flowers are white, and are borne in a lax raceme on a slender scape. There is a drawing in the collection marked "Wynaad, Sept., Jerdon's sale, 1873," which is evidently the same species, but it does not appear to have been previously described.

55. **Cœlogyne tenuis,** *Rolfe*; pseudobulbis conico-elongatis monophyllis, foliis elliptico-lanceolatis breviter acuminatis sessilibus, scapis gracilibus paucifloris, bracteis lanceolatis acuminatis imbricatis deciduis, sepalis oblongo-ovatis subacutis concavis, petalis linearibus subacutis, labello trilobo lobis lateralibus semiorbicularibus intermedio ovato apiculato, disco tricarinato carinis lateralibus elevatis basi in laminam dentiformem productis, columna arcuata elongata.

HAB. Borneo.

Scapus circa 6 poll. altus. *Bracteæ* 5–6 lin. longæ. *Pedicelli* 4 lin. longi. *Sepala* 6 lin. longa, 2 lin. lata. *Petala* vix ½ lin. lata. *Labellum* 5-lin. longum, 2½ lin. latum. *Columna* 4½ lin. longa.

This species belongs to Lindley's section *Flexuosæ*, and may be placed next to *C. borneensis*, Rolfe (*supra* p. 62). It differs in its one-leaved pseudobulbs, slender scapes, and other characters. It was introduced by Messrs. Linden, of L'Horticulture Internationale, Brussels, with whom it flowered in August 1892. The flowers were somewhat withered when received, but appear to be of a light buff shade, with very few markings on the lip. The pseudobulbs and leaves are described from a reduced sketch.

56. **Epidendrum pumilum,** *Rolfe*; herba pumila, caulibus erectis foliosis verrucosis, foliis distichis sessilibus parvis cordato-oblongis bidentatis subconvexis, racemis terminalibus brevibus 3–4-floris, bracteis ovato-lanceolatis acutis, sepalis patentibus late elliptico-oblongis subobtusis v. minute apiculatis subconcavis, petalis patentibus spathulato-obovatis subobtusis v. minute apiculatis concavis, labelli ungue ad columnam adnato limbo trilobo lobis lateralibus parvis oblongis cum intermedio cruciatis intermedio late unguiculato apice dilatato bilobo lobis inciso-denticulatis callo late oblongo apice tridentato, columna brevi clinandrio late marginato carnoso truncato.

HAB. Costa Rica.

Caules 4–5 poll. alti. *Folia* 3–6 lin. longa, 2–3 lin. lata. *Racemi* vix pollicares. *Bracteæ* 1½–2 lin. longæ. *Pedicelli* 4–5 lin. longi. *Sepala* 3 lin. longa, 2 lin. lata. *Petala* sepala æquantia sed paullo angustiora. *Labellum* 3 lin. longum, apice 1½ lin. latum. *Columna* 2 lin. longa.

A pretty little species allied to *E. Endresii*, Rchb. f. (apparently the nearest ally which has yet appeared), but very different in the shape of its leaves and colour of its flowers. It was imported by Messrs. F. Sander & Co., of St Albans, with whom it flowered in January, 1890. Early in the present year it was also received for determination from Mr. F. W. Moore, Glasnevin Botanic Garden. The sepals and petals are light greenish yellow, also the lip, with the exception of the orange-yellow callus. The column is very pale green below, nearly white above. As in *E. Endresii*, the sheaths of the leaves are covered with small brown warts.

57. **Polystachya imbricata**, *Rolfe;* caule erecto subgracili diphyllo, foliis oblongo-linearibus acutis, spicis ramosis congestis ramulis abbreviatis, bracteis imbricatis rigidis ovatis acuminatis, sepalo posticco ovato-oblongo acuto lateralibus obliquis basi pedi columnæ adnatis postico latioribus, petalis spathulatis, labello trilobo pubescente lobis lateralibus late rotundatis intermedio rotundato-oblongo apiculato callo quadrato, columna brevissima.

HAB.—E. Trop. Africa, Upper Zambesi River.

Caules circa 3 poll. longi. *Folia* 3½–4½ poll. longa, 5–6 lin. lata. *Bracteæ* 1–2 lin. longæ. *Pedicelli* 3 lin. longi. *Sepalum posticum* 3 lin. longum; *lateralia* 4½ lin. longa. *Petala* 2 lin. longa. *Labellum* 3 lin. longum.

This species was sent by Mr. J. O'Brien, of Harrow-on-the-Hill, Middlesex, with whom it flowered in August 1891. It may be placed near to *P. ensifolia*, Lindl., which, however, has much longer leaves and a lax inflorescence. There does not appear to be any species with which the present one can easily be confused. The sepals are pale yellow, the lateral ones suffused with pink along the margins; the petals straw-colour, and the lip pink, with a yellow callus, and wholly pubescent inside.

58. **Oncidium luteum**, *Rolfe;* pseudobulbis ovatis compressis, foliis lanceolato-linearibus obtusis, paniculis amplis laxis multifloris, bracteis ovatis acutis, sepalis unguiculatis lineari-lanceolatis subobtusis concavis, petalis breviter unguiculatis elliptico-oblongis apiculatis v. obtusis, labello pandurato lobis lateralibus orbiculari-oblongis intermedio obcoridato apice breviter bilobo crista circa 10-tuberculata instructo, columna brevi recurva basi in processum cornutum producta alis magnis basi-oblongis apice dilatato-tricuspidatis rostello elongato.

HAB. Not recorded.

Pseudobulbi 1¼ poll. longi. *Folia* 4 poll. longa v. forsan ultra, 6 lin. lata. *Panicula* 1½ ped. longa. *Bracteæ* 1½–2 lin. longæ. *Pedicelli* 5–6 lin. longi. *Sepala* 3½–4 lin. longa. *Petala* 3 lin. longa. *Labellum* 4½–5 lin. longum, 4 lin. latum.

This *Oncidium* flowered in the collection of Sir Trevor Lawrence, Bart., Dorking, in June, 1892, when it was sent to Kew for determination. It is closely allied to *O. chrysopyramis*, Rchb. f., but that species has invariably a broader isthmus to the lip, and a few other structural differences which seem to indicate the distinctness of the present one Its flowers are uniformly light yellow, and borne in a large lax panicle. It belongs to a group of species in which the column and its elongated rostellum resemble the head and beak of a bird, from which one of the species, *O. ornithorhynchum*, Kunth, derived its specific name. Lindley distributed the species into four or five different sections, but they are so intimately allied as to leave no doubt of their forming one natural group, which may bear the name *Rostrata* (a name used by Lindley in a more restricted sense). About 20 species have been described, but several of them are still very imperfectly known.

59. **Luisia amesiana**, *Rolfe*; caule erecto, foliis teretibus rigidis subobtusis, racemis axillaribus abbreviatis paucifloris, bracteis patentibus triangulo-ovatis subobtusis concavis rigidis, sepalo postico elliptico-ovato obtuso lateralibus subobliquis lanceolato oblongis subobtusis, petalis

elliptico-oblongis obtusis, labello trilobo lobis lateralibus rotundatis brevibus intermedio orbiculari isthmo lato disci venis paullulo incrassatis, columna brevissima crassissima.

HAB.—Southern Shan States, Burma.

Folia 5–7 poll. longa. *Racemi* vix 1½ poll. longi. *Bracteæ* 2 lin. longæ. *Pedicelli* 9–12 lin. longi. *Sepala* 6–7 lin. longa, 3–4 lin. lata. *Petala* sepalo postico æqualia. *Labellum* 7–8 lin. longum, 5–6 lin. latum. *Columna* vix 2 lin. longa.

This species was sent to Kew by Messrs. Hugh Low & Co., of Clapton, in June 1891, who state that it was imported together with *Vanda Kimballiana*, Rchb. f. Thus its habitat must be on the hills of the Southern Shan States, at 4,000 to 5,000 feet elevation. Shortly afterwards it was sent by Messrs. F. Sander & Co., of St. Albans, who gave its native country as "Burma." It has since been received from Glasnevin. It is allied to *L macrotis*, Rchb. f., but has flowers more than twice as large. The sepals and petals are pale yellowish white, slightly suffused with purple near the apex, and having a few obscure dull purple markings on the back. The lip is suffused with purple, and blotched with dark purple, the margin being light greenish yellow. The column is pale green.

60. **Habenaria cinnabarina**, *Rolfe*; pusilla, foliis erectis lineari-attenuatis acutissimis subconduplicatis, scapo foliis breviore (an semper ?), racemo paucifloro subcorymboso, bracteis subulato-lanceolatis acuminatis, sepalo postico erecto cucullato obtuso lateralibus patentibus subobliquis late semiobovatis obtusis v. apiculatis leviter carinatis, petalis erectis lineari-oblongis subobtusis, sepalo postico appresso galeam formante, labello trilobo lobis lateralibus semiorbiculari-oblongis minute crenulatis cum intermedio cruciatis intermedio oblongo obtuso calcari recto clavato, columna brevi rostello obovato-oblongo bidentato.

HAB. Madagascar.

Folia 3–5 poll. longa, 2–4 lin. lata. *Scapus* 3 poll. altus. *Bracteæ* 5–7 lin. longæ. *Ovarium* 5 lin. longum. *Sepalum posticum* 2 lin. longum; *lateralia* 2½–3 lin. longa. *Petala* 1½ lin. longa. *Labellum* 3½–4 lin. longum. *Calcar* 4 lin. longum. *Rostellum* vix 2 lin. longum. *Pollinia* 2½ lin. longa.

This species was introduced by Messrs. W. L. Lewis & Co., of Southgate, together with *Disa incarnata*, Lindl. and *Cynorchis grandiflora*, Ridl. The colour of its flowers is rather unusual, being cinnabar-orange, with a few red spots on the back of the sepals, and thus resembling those of *Disa incarnata* from the same locality. The plant here described has nine flowers and buds, but appears as if very imperfectly developed, and normal specimens may be much larger. It is very different from everything hitherto described from Madagascar, so far as can be discovered, but its exact affinity remains a little doubtful.

CCCXXIII.—EARLY HISTORY OF BUITENZORG BOTANIC GARDENS.

The historical account of Kew to 1841, published in the *Kew Bulletin* for December 1891, contained brief notices of the history of many Kew men who had been occupied with botanical work in different parts of the world early in the century.

Amongst these James Hooper was omitted, as, though his name was known, the facts of his life had been lost sight of. This omission is now remedied by the following interesting letter from the distinguished Director of the Botanical Garden at Buitenzorg in Java.

Dr. TREUB to ROYAL GARDENS, KEW.

Buitenzorg (Java),
April 24, 1893.

MY DEAR THISELTON-DYER,

YOU are aware, I suppose, that Reinwardt, who was Professor in Amsterdam and afterwards in Leyden, was the man who created in 1817 the "Government Botanical Garden ('s Lands-Plantentuin)" in Buitenzorg. In his proposition to the Colonial Government of 15th April (No. 53) Reinwardt pointed out: "There is now a rare as well "as favourable opportunity to get a very able and specially trained "man for the service of a botanical garden. It is a man named James "Hooper who, by special recommendation of Sir Joseph Banks, joined "the recent British Embassy to China. He stayed here to try to "get a position. There is not only that recommendation, but Mr. Abel, "the naturalist to the Embassy, and the Ambassador Lord Amherst "himself, gave me the best testimony as to Hooper's ability in cultiva-"ting and propagating plants. Lastly Hooper has had a service of "six years in one of the most renowned and richest gardens of Europe, "viz., in the Royal Gardens at Kew, where he has had charge of the "general cultivation of plants, so I may suppose him to be quite the "right man for the work I intend to charge him with."

This proposition of Reinwardt's being accepted, James Hooper was appointed by the Colonial Government as a "hortulanus" of the new botanical garden in Buitenzorg, at a salary of 150 guilders monthly, with free use of a government house.

There were two hortulani, but the other head gardener named W. Kent nearly always travelled over Netherlands India with Reinwardt, and afterwards left the Botanical Garden to enter into the civil service as an assistant of the inspector of the coffee culture.

So, in fact, James Hooper was head gardener of the Buitenzorg Garden from 1817 till 1830. His salary was raised to 250 guilders per month.

The 4th December 1830 J. Hooper left Java on furlough for Europe, in order to restore his health; he did not reach Europe, but died on board the vessel. He was succeeded by Teysmann.

Our first head gardener, who stayed here 12 years, having been trained at Kew, you see that Buitenzorg has from the beginning been greatly indebted to Kew. That "most renowned of European gardens," to make use again, after 76 years, of Reinwardt's words, has never failed since that time to give in the most liberal way help and assistance to the Buitenzorg Gardens.

Yours very sincerely,
(Signed) M. TREUB.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S.,
Royal Gardens, Kew.

The Embassy mentioned above was that of Lord Amherst to the Court of Pekin during the years 1816–17. The circumstances of James Hooper's attachment to it are detailed by Abel, who acted as naturalist to the expedition.

EXTRACT from the Preface to "Narrative of a Journey in the Interior of China," by Clarke Abel, F.L.S., London, 1818.

My appointment to the Embassy was at first simply medical, but through the recommendation of Sir Joseph Banks to the East India Company, I was permitted to take upon me the office of naturalist, and received an ample outfit of all the apparatus for scientific research. To give greater effect to my exertions in collecting and preserving the vegetable productions of the countries to be visited by the Embassy, a botanic gardener, from the Royal Gardens at Kew, taking out with him a plant cabin for the preservation of living specimens, was placed under my directions, and to assist generally in my pursuits my brother-in law, Mr. Poole, was allowed to attend me. With such facilities it would have been strange, even in countries often trod by scientific men, if I had not gleaned some new and important facts. But in China, scarcely touched by the foot of the naturalist, nothing short of a rich harvest could have been received as a token of my due exertions. The proofs of what these were, of their efficiency or abortiveness, are buried in the Straits of Gaspar. But it is incumbent on me to bear testimony to the exertions of Mr. Hooper, the botanic gardener, whose industry was equally unremitting and availing. His more peculiar department having been to collect and preserve seeds, he placed, on our leaving China, 300 packages in my keeping, many of which were taken from plants of undescribed genera, and by far the greater number from unknown species. They formed part of the shipwrecked collection.

After leaving the wreck of the "Alceste," I had the mortification of hearing that the cases containing these seeds had been brought upon deck and emptied of their contents by one of the seamen, to make room for some of the linen of one of the gentlemen of the Embassy.

The "Alceste" was wrecked on Pulo Leat. Lord Amherst and 32 of the crew succeeded in escaping to Batavia, where they were received with the greatest kindness by the Dutch governor. The remainder of the crew were subsequently rescued, but in the meantime the wreck had been burnt by the Malays including, as Abel records, p. 256, "a collection of plants, seeds, and minerals, which had been made in China." James Hooper evidently left the Embassy at Batavia, Abel returning to England.

CCCXXIV.—PRUNE CULTIVATION IN CALIFORNIA.

The following correspondence refers to the correction of an error in the table published in the *Kew Bulletin*, for November 1892, giving the foreign import and California production of prunes for the six years from 1885 to 1891 inclusive.

Monsieur GAJAC to ROYAL GARDENS, KEW.

MONSIEUR, Clairac, le 12 janvier, 1893.

M. COLCHESTER-WEMYSS a eu l'obligeance de m'envoyer le bulletin de Kew de Novembre dernier, et m'a procuré ainsi le plaisir de lire la notice qu'il contient sur la prune de Californie. Les quelques rapports que, grâce à M. Wemyss, j'ai eu l'honneur d'avoir avec vous, Monsieur, me faut espérer que vous voudrez bien accueillir une double demande que je prends la liberté de vous adresser à propos de cet article.

La première concerne le tableau statistique qui termine la notice. Il contient d'abord l'importation totale des prunes aux Etats-Unis de 1889 à 1891 avec sa valeur en dollars. Ce renseignement nous interesse beaucoup, et étant officiel, il doit être exact. Or la seconde partie du tableau contient l'indication des quantités produites en même temps en Californie et leur valeur en livres sterlings. Là il me semble qu'il y a erreur et que les petites quantités indiquées pour 1886, 1887, 1888 n'ont pu produire les sommes qui leur sous attribuées.

Fixé par ce que dit la notice sur l'importance croissante de la production californienne et sur son prix moyen, je n'ai aucun intérêt à connaître les chiffres exacts qui doivent remplacer ceux que probablement une erreur d'impression a placés dans votre bulletin ; ce que je désiré savoir, c'est si la première partie du tableau est exacte en ses quantités de poids et ses nombres en dollars. Comme il n'y a guère que la Bosnie et nous qui concourions à l'importation, ce renseignement précis a de l'intérêt pour nous. Voilà ma première demande ; la seconde sera peu discrète ; je vous prierai en effet, Monsieur, de me faire tenir deux exemplaires de votre bulletin de Novembre dernier, si cela ne vous dérange pas.

Avec la confiance que vous voudrez bien excuser mon importunité je vous prie d'agréer, Monsieur, l'expression de ma considération distinguée.

E. GAJAC.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, January 18, 1893.

I HAVE the honour to inclose a copy of a letter which I have received from M. Gajac, a correspondent of the Royal Gardens, who is engaged on an important scale in the French prune industry.

He has received from Mr. Colchester-Wemyss, who a few years ago visited the French prune district for the purpose of studying the industry, a copy of the November number of the *Kew Bulletin*, in which Mr. Vice-Consul Moore's report on the prune industry of California was in part reproduced. M. Gajac draws attention to the statistics printed on p. 16 of the report, and these certainly seem open, as they stand, to some doubt. Taking two years, the California production stands as follows :—

——	Produce.	Value.
	lbs.	£ s. d.
1887 - - -	1,825,000	619,761 19 6
1889 - - -	15,200,000	294,071 1 5

It will be noticed that where the produce is in the latter year seven times as great, the gross value is only one-half. That an article of this kind should fall in value in the time to one-fourteenth seems improbable.

As M. Gajac has drawn attention to the matter it might be worth while having the accuracy of the figures tested. I may add that

M. Gajac gave Mr. Colchester-Wemyss the greatest assistance in his mission, which was all the more generous on his part, as Mr. Colchester-Wemyss did not conceal the fact that his object was to introduce the process of prune manufacture into the south of England.

I am, &c.
(Signed) W. T. THISELTON-DYER.
Sir Villiers Lister, K.C.M.G.,
Foreign Office.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, March 10, 1893.

WITH reference to my letter of the 23rd of January last, I am directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before Mr. Thiselton-Dyer, the accompanying despatch with reference to a previous report on the prune industry of California.

I am, &c.
The Assistant Director, (Signed) E. GREY.
Kew Gardens.

British Consulate, San Francisco,
MY LORD, February 18, 1893.

WITH reference to Sir E. Grey's despatches, Commercial No. 2, of the 26th November last, and Commercial No. 1 of the 23rd ultimo, relative to Mr. Vice-Consul Moore's report on prune culture, published in Report No. 245 Miscellaneous Series of 1892, I now have the honour to enclose a despatch, which I have received from Mr. Moore, dealing with this subject. Judging from the official source from which Mr. Moore obtained this information it was naturally supposed that the figures and text were correct.

In my Annual Report for the year I shall refer further to this matter.

I have, &c.
(Signed) DENIS DONOHOE.
Her Majesty's Principal Secretary of State
for Foreign Affairs, London.

British Consulate, San Francisco,
SIR, February 17, 1893.

IN reference to Foreign Office despatches, No. 2 Commercial, of the 26th November 1892, and No. 1 Commercial, of the 23rd ultimo, in reference to a report on the prune industry of California which I prepared last year, I have the honour to state as follows:—

My report was prepared, as stated therein, from that of the State Board of Horticulture, a bureau established by the State Legislature to further the interests of fruit growers by collecting and publishing statistics of fruit culture and of making known the opinions of the leading men of the industry as to the best and newest methods of horticulture, and anything that would assist in promoting and furthering the industry. The Commissioners are practical men, and some of them are among the largest and most successful fruit growers of the State. It would naturally be expected that a body of this description would be careful that anything published by it would be prepared with great care, and I was under this impression when I drew my information from that source. From inquiries since made, I have come to the conclusion that their report on this subject was very carelessly prepared, and that many of the statements made therein are much exaggerated. As you are aware, I have written to the Secretary of the State Board of Horticulture for an explanation of some of the statements, but he has failed to reply. I then took steps to obtain information from a prune grower of experience, and will ask you to embody in your Annual Report, now in preparation, some information I obtained which will correct the exaggerated statements which appeared in my report.

The sterling figures are the equivalent of the currency column of the table, and do not apply to the Californian production at all.

The table should have been prepared as follows, which would have prevented any mistake being made.

Years.	Foreign Imports, by Years, ending June 30.		California Production, by years, ending December 31.
	Pounds.	Value in Sterling.	Pounds.
		£ s. d.	
1885 - -	57,631,820	443,699 7 4	—
1886 - -	64,995,545	418,717 19 4	2,000,000
1887 - -	92,032,625	619,761 19 6	1,825,000
1888 - -	70,626,027	453,956 12 1	2,100,000
1889 - -	46,154,825	294,071 1 5	15,200,000
1890 - -	58,093,410	369,663 19 2	12,200,000
1891 - -	34,281,322	424,480 11 5	27,000,000

I have, &c.
(Signed) Wellesley Moore.

Denis Donohoe, Esq.,
H. B. M. Consul,
San Francisco.

Since the above was in type, the following further information on the same subject has just been published in a report issued by the Foreign Office (Annual Series, 1892, No. 1293, Diplomatic and Consular Reports on Trade and Finance.—Report for the year 1892 on the Trade and Agriculture of the Consular District of San Francisco) :—

In regard to a report on the prune industry of California, which was prepared last year by Mr. Vice-Consul Moore, of this Consulate, and published in No. 245 of the Miscellaneous Series, Mr. Moore desires to state that the source from which he obtained his information was the Annual Report of the State Board of Horticulture of this State, and that from inquiries since made he has come to the conclusion that some of the statements that appear in his report are erroneous and exaggerated, and he wishes to correct them as follows :—

"In regard to the statement that Californian prunes brought higher prices than the imported article, this observation should only be applied to the 'prunes of commerce,' and not to the 'article de luxe.' The prune is consumed in this country principally by the masses, who use it for sauce (*i.e.*, stewing), and for this purpose it is superior to the French owing to the fact that it is sun-dried, while the French has already been cooked in preparation being subjected in a 'drier' to successive heatings, 50° C., 70° C., and finally 90° C. For eating without cooking, however, the finest French prunes are still unapproachable.

"Instead of the outlook for Californian prunes as a profitable crop looking very bright for years or generations to come, it would seem that in a very few years the production will be so great that the producers will have to look abroad for a market. There has been a great deal of planting done in the last three years in Santa Clara county, as well as not a little in San Benito and Tulare counties. I understand that Alameda, Los Angeles, Orange, Solono, and Sonoma counties are all producing a considerable quantity, and no doubt in a few years the total will be enormous. It must also be remembered that Oregon raises Italian prunes. Mr. Lieb, a prominent fruit-grower of Santa Clara county, estimates the shipments from San José for 1893, with a full crop, at 50,000,000 lbs., and Colonel Hersey, another prominent gentleman in the business, is reported as saying that the trees now planted in that country (Santa Clara) will eventually produce 200,000,000 lbs. I give these estimates for what they may be worth, but no doubt production will shortly be very great, and prices fall, but this in itself will increase consumption, to a certain extent, among the 65,000,000 people in this country.

"The duty of 2 c. a pound on foreign prunes imported into the United States has had a great effect in stimulating the sale of the Californian article in the Eastern States, but whether they will succeed in entirely driving out foreign prunes from the American Markets will depend a great deal on the maintenance of this duty and on freight rates from here to the east. It is open to doubt if any over-prodution could be appreciably relieved by export except at very low prices. Consumption in Australia is comparatively small, and duty and charges very high. The cost of laying down in England is heavy and the demand light, and the fruit is required there in November, which for boxed goods is impossible.

"The average yield of fruit in Santa Clara Valley, the chief producer, is thought to be nearer 100 lbs. of fruit per bearing tree than 300 lbs. The calculation that it will dry out three to one may be taken as about an average. This would consequently produce about 33 lbs. of dried fruit per tree for Santa Clara Valley, and as that is an especially favourable location for the prune, the average for the state would be lower. The yield of 1,102 lbs. credited to a tree in Visalia is probably correct, but it is growing on deep bottom land, and such soil is limited in extent.

"The yields given for the third, fourth, fifth, and sixth years are regarded as unreliable for a properly pruned orchard, and if it were possible by light pruning to obtain such yields, which is doubtful, it would be the ruin of the orchard.

"There is an error on page 4 of the report, where it states that 300 acres near Templeton contain 324,000 prune trees. This should be 32,400 trees, at 108 to the acre.

"An error was also made in printing the table (already explained above)."

CCCXXV.—PLANT INDUSTRIES OF LAGOS.

The important colony of Lagos on the West Coast of Africa possesses such valuable resources that it is difficult to over-estimate them. Numerous articles have already appeared in the *Kew Bulletin* respecting the vegetable productions of the Colony, treating also of the very intelligent efforts made to develop them by the aid of the Botanical Station successfully established at Ebute Metta in 1888.

The experiments so far made in cultural industries are necessarily confined to the coast region. It is probable, however, that in time plantations will be extended into the fruitful Yoruba country, where the soil and climate are well suited to support a considerable industry. Very valuable information respecting the cultivation by natives already existing in Yoruba-land was prepared by Mr. Alvan Millson, and published in the *Kew Bulletin*, 1890, p. 238.

Recently a very important mission was undertaken by the Governor, Sir Gilbert Carter, K.C.M.G., into the interior of the colony, and the results are likely to prove of great interest. The indigenous plants noticed in the interior were collected by Dr. Rowland, the medical officer to the mission, and these are now being worked out at Kew.

In the meantime, the following correspondence has been communicated to Kew by the Secretary of State for the Colonies respecting visits paid to the eastern and western districts of the colony by the Deputy-Governor, Captain Denton, C.M.G., who was accompanied by Mr. Henry Millen, the Curator of the Botanical Station. Mr. Millen's observations are calculated to prove of general service in drawing attention to the present conditions of industrial enterprise in Lagos.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

Colonial Office, Downing Street,
25th March 1893.

SIR,

I AM directed by the Marquess of Ripon to transmit to you the enclosed copy of a despatch from the Officer Administering the Government of Lagos, forwarding a report by the Curator of the Botanic Station on the resources of the western district of the Colony, and I am to state that his lordship would be glad to be favoured with any observations which you may have to make upon it.

I am, &c.
(Signed) JOHN BRAMSTON.

The Director,
Royal Gardens, Kew.

THE OFFICER ADMINISTERING THE GOVERNMENT OF LAGOS to COLONIAL OFFICE.

Government House, Lagos,
14th February 1893.

MY LORD,

I HAVE the honour to inform your lordship that I was accompanied by the Curator of the Botanic Station on my recent visit to the western district, and I now beg to transmit a report by that officer giving his views on the resources of that part of the Colony and Protectorate from a botanical aspect.

Mr. Millen first deals with the cocoanut plantation at Badagry, and so far as I am able to judge, his remarks are perfectly correct. For a considerable time it was the practice to have the plantation cleaned at regular intervals by paid labour, but this appears to have been discontinued of late. No doubt it entailed a heavy expenditure, and it is a question whether an outlay of this nature is a legitimate charge on the public funds.

That cocoanuts will do well in the western district is proved by the plantation at Topo, which is in excellent order, and has progressed wonderfully since my last visit there 18 months ago. It must, however, be remembered that the mission lands are looked after by two priests, specially selected for the work on account of their agricultural experience, who have some 40 odd men and boys to assist them. Were the trees at Badagry to receive like advantages, I have no doubt that they would thrive equally well, but I cannot think that it is desirable for the Government to burden itself with undertakings of such magnitude.

I was not much struck with the coffee plantation near Ajilete which still has but little to show for the amount of labour which I understand has been expended on it. As yet no trees have been placed in their permanent positions, and I should say that not more than 25 acres of ground have been cleared.

It must be recognised that coffee planting near Lagos is an experiment, and looking to the quality of the land taken up, I am not too sanguine as to good results being obtained.

Captain Davies' plantation on the Itele creek has been established some years, and very fair cocoa is to be found in it. It has, however, suffered from want of capital and skilled experience, but were these forthcoming it should prove a very remunerative undertaking.

The great difficulty in all plantation work here is the labour; the natives of the country will not work except in the most spasmodic manner, and nothing can be effected unless men are imported from the Kroo Coast. And here again there is a difficulty, for the Krooman objects to be placed in the isolated parts of the country where the plantations are situated, and frequently runs away to Lagos. If brought before the courts of the Colony, he is of course punished for breaking his agreement, but this is of little real service as he takes his revenge on his master by doing the smallest amount of work possible when he is sent back to the plantation.

Mr. Millen reports that rubber-growing trees are abundant from Shagbo to Ilaro, and he undoubtedly found some very fine specimens of the *Landolphia owariensis.* Great difficulty has been experienced in obtaining the services of trained rubber collectors, but I hope that in time this may be surmounted. At the present moment the Government have an experienced man collecting rubber in the neighbourhood of Jebu Ode, and later on it may be worth while to send him to Ilaro for a similar purpose.

With regard to the *Raphia vinifera* palm, this abounds in all parts of the country. There is already a small trade in the fibre or bass obtained from it, and I have every reason to believe that it will be very largely increased during the next twelve months. Should my expectations be realised, it should prove an important addition to the exports of the colony as the supply is practically inexhaustible.

I have, &c.

(Signed) George C. Denton.

The Most Hon. The Marquis of Ripon, K.G.,
&c. &c. &c.

(Enclosure.)

Botanical Station, Ebute Metta,
9th February 1893.

SIR,

I have the honour to forward for the information of the Deputy Governor the following report on my visit to the Western District.

The first plantation visited was the Government plantation at Badagry, situated close to the sea. Here a large area is devoted to the growing of cocoanuts: these trees are in two stages of growth, the larger ones are in a healthy condition, the younger ones are not established yet. Attention is required to clear away the long growing grass which surrounds them. A small quantity of the *Sansevieria guineensis* is also grown, the leaves are small, but I believe this is due to the dry season. A strong and useful fibre is obtained from the leaves of this plant.

A short distance from the town of Ajilite a coffee plantation is in course of being laid out by European enterprise. The work of clearing the ground is being done, and preparations made for planting out during the next rains. A nursery for raising young plants has also been established, and about 18,000 seedlings are now ready to be planted out, while a large quantity are in a less advanced state. Mr. Campbell calculates to plant out 40 acres in the next rains. The soil is a loamy marl, and is said to be workable at all seasons.

The plantation at the Catholic Mission, Topo, consists of a large portion of land on the sea side of the lagoon opposite the village of Topo. A large area has been planted with cocoa-nut trees, which are represented in all stages of growth. About 23,000 have been planted out, while 15,000 are in the nursery ready for planting. The trees are in a healthy and flourishing condition. Among other things cultivated may be mentioned cassava, banana, and pine-apple. An European vegetable garden is also connected with this plantation. It is situated in low moist ground, a stream surrounding it, and the soil is rich in vegetable matter. Under these conditions vegetables grow luxuriantly. Attached to the Mission is an agricultural school. Here part of the day is devoted by the scholars to work connected with the plantation. The estate is kept clean and in a flourishing condition, and is highly creditable to those superintending the work.

The next plantation I visited was that belonging to Captain J. P. L. Davies, near Itele. This was the first one established in the Colony. Captain Davies introduced cacao or chocolate plants from Fernando Po some years ago, and has now about 10,000 trees planted out, many bearing fruit. The land here is well suited for cacao, as can be seen by the flourishing condition of the plants. The plantation is surrounded by low swampy ground, from which there is a gradual rise to a low plateau. The principal plants grown are: cacao, kola, annatto, cocoanuts, and a few coffee plants. Several tons of commercial cacao are shipped annually from this plantation, the last consignment realising 62*s*. per cwt. I pointed out to Captain Davies that the trees required pruning. The pods produced were a good size, and the beans fully matured. A good plan, and one which answers well in planting cacao, is being followed on this plantation. Roads are cut running parallel through the forest about three yards wide; the cacao plants are then planted in the centre, the growth of trees on each side forming shade, under which the plants thrive well as they become established. The growth on the sides can be cut away when necessary. The plantation consists of 300 acres, and Captain Davies, who takes a great interest in it, would with more regular and abundant labour be able to keep it in a workable condition.

COLLECTING PLANTS. It being the dry season it was not a suitable time for making a good collection of specimens for the Herbarium, and many of the plants were in seed. I collected about 50 specimens, most of these being collected in damp and marshy ground. A number of living plants were also collected, which will be planted in the gardens.

RUBBER. *Landolphia owariensis*, *L. florida*, and an unnamed species. These plants are found almost everywhere in more or less abundance, especially between Shagbo and Ilaro. The rubber is not collected. though there is no doubt, if properly sought for, sufficient plants would be found to bring in a good supply.

TIMBER TREES. One of the largest trees met with in the forests is the Iroko tree (*Chorophora excelsa*). This wood is much used for building on account of its durability. *Adansonia digitata* is frequently seen. *Ficus guineensis* and other species are found in large quantities by the streams and in marshy ground. *Cola acuminata* trees grow wild in the forests round Ilaro; they appear to flourish best under the shade of the forest trees.

PALMS. The oil palm, *Elæis guineensis*, is found in large quantities near the water. *Raphia vinifera* (Bamboo palm) abounds in the swamps one passes after leaving Badagry. Its fibre does not appear to be collected although it is so valuable. From this palm, however, the natives not only extract their favourite beverage, palm wine, but its young branches are used for thatch, and for the framework in the walls and roofing of their houses. A kind of *Calamus* is very common. It is used by the natives under the name of "tie-tie" in lieu of string or rope, and also for making baskets, &c.

AQUATIC PLANTS. *Cyperus Papyrus* fringes the banks of the rivers and streams, and is continually blocking the waterway. This plant has been known from an early date, being the well-known papyrus reed of the Egyptians. *Pistia stratiotes*, a floating plant, also abounds in the small creeks, the water being sometimes completely covered with it

STROPHANTHUS KOMBE and another species are found growing here and there in the forests. The seeds are used in Central Africa for poisoning arrows. There is a demand for them in Europe.

A species of *Vanilla* is found in damp forests attached to trees. I could not obtain specimens of the flower. It would be interesting to find whether this plant produces beans at all similar to the vanilla beans of commerce.

If properly worked, and careful attention given to them, the prospects as regards the plantations in this part of the Colony are very favourable. Before planting it is necessary to obtain fertile land. Ilaro offers a fine field for plantations. The soil there is rich and prolific, and the land has an elevation of several hundred feet above the sea. Added to this, waterways traverse nearly every part of the Western District, which gives great facility for transport.

I have, &c.
(Signed) HENRY MILLEN,
Curator.

His Excellency the Deputy Governor,
Lagos.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 22nd April 1893.

WITH reference to the letter from this Office, of the 25th ultimo, I am directed by the Marquess of Ripon to transmit to you a copy of a despatch from the Deputy Governor of Lagos, forwarding a report by the Curator of the Botanical Station of a recent visit to the Eastern District of that Colony.

His Lordship will be glad to be favoured with any observations that may occur to you in connexion with this report.

I am, &c.
(Signed) JOHN BRAMSTON.

The Director,
Royal Gardens, Kew.

DEPUTY GOVERNOR, LAGOS, to COLONIAL OFFICE.

MY LORD, Government House, Lagos, 25 March 1893.

I HAVE the honour to forward the accompanying report by the Curator of the Botanical Station on a recent visit made by him to the Eastern District.

Mr. Millen took every advantage of the opportunity offered him of acquiring a knowledge of the botanical resources of this part of the Colony and Protectorate, and I submit that his remarks on the subject generally will be of value to those interested in the question.

I have, &c.
(Signed) GEORGE C. DENTON.

The Most Honourable
The Marquess of Ripon, K.G.,
Secretary of State for the Colonies.
&c. &c. &c.

(Enclosure.)

SIR, Botanical Station, Lagos, March 9, 1893.

I HAVE the honour to submit for His Excellency the Deputy Governor's information the following report on my visit to the Eastern District.

This District is similar to the Western District, in having a good waterway. Many of the towns we visited lay on the banks of the lagoon, and so one had not so good an opportunity for exploring the forests in search of plants. Nevertheless, a small collection was made for the Herbarium, although at this season many plants are producing seed. A good many living specimens were also obtained, including plants of *Platycerium*, *Rhipsalis*, and epiphytal orchids, most of the latter belonging to the genus *Bulbophyllum*. The banks of the lagoon and the creeks which run into it have scarcely any other vegetation than the Bamboo Palm (*Raphia vinifera*) with stretches of Mangroves.

The first place we landed at after leaving Lagos was Epo. The land here is undulating and the soil good. Cassava, yams, and native vegetables are grown, and in the low valleys sugar-cane is planted. The forest round the town is being gradually cleared for cultivation. The natives seldom use the same land two years in succession, as it is not the custom here to enrich the soil with manure. Trees of the supposed Barwood and Strophanthus, and of *Sesamum indicum* were growing wild. I collected several of these plants. A strong fibre, probably from the Baobab tree (*Adansonia digitata*) was being used for rope-making.

At Leckie large groves of the Bamboo palm (*Raphia vinifera*) abound, also *Elæis guineensis* or African oil palm. An unlimited supply of African bass fibre could be obtained in this district. The soil is very sandy, and being close to the sea, the land is very suitable for the cultivation of the cocoanut palm.

The Government has a plantation consisting of about 8,000 plants; these are planted in rows along the seashore, and appear to be in a healthy condition, many of them have already begun to bear fruit. Coffee has also been tried here in a small way, but its cultivation was not attended with success.

On leaving Leckie and proceeding towards Artijere, the Bamboo palm is replaced by trees, one of which is the Frankincense tree of Sierra Leone (*Daniella thurifera*). Many of the trees are covered with epiphytal plants of the orchid family. Yams, cassava, and sugar-cane are the principal products. From Artijere, Itebu is reached by a fine river, the vegetation on each bank being chiefly the Bamboo palm. Past Itebu, Ayesan is reached, which is a large town some height above the river. The soil along the banks of the river here should be rich in vegetable humus, obtained from the decayed palms and trees, and would therefore be suitable for the cultivation of many useful plants. A small plot of coffee is being grown in the neighbourhood, and by the account given it was thriving satisfactorily. I succeeded in collecting several interesting plants in this neighbourhood.

I have, &c.
(Signed) H. MILLEN, Curator.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, July 6, 1893.

I AM desired by Mr. Thiselton-Dyer to acknowledge the receipt of your letters of the 25th March and the 22nd April last, forwarding copies of despatches from the Deputy-Governor of Lagos, with Reports by the Curator of the Botanical Station on recent visits paid to the Eastern and Western Districts of the Colony.

2. The collections of plants made by Mr. Millen in these districts were received at Kew in June last, and they have now been examined and determined. The plants were in an excellent state of preservation and fully labelled. Many species have proved to be new, and the results are very creditable to Mr. Millen, who should be encouraged to continue to collect plants and to furnish useful notes respecting their properties and uses. A complete list of the plants included in Mr. Millen's collections is enclosed herewith. This may be forwarded for the information of the Government of Lagos, and also be communicated to Mr. Millen.

3. The valuable information contained in the despatches of Captain Denton, C.M.G., the Deputy-Governor, and in the more detailed reports furnished by Mr. Millen, afford a very clear idea of the present condition of some of the plant industries of the Colony. Many of these were started, in the first instance, by the late Governor, Sir Alfred Moloney, and there is little doubt that they are capable under the judicious guidance of his successor, of being greatly developed in the future.

4. Mr. Thiselton-Dyer would be glad, with the permission of the Secretary of State, to publish these papers in the *Kew Bulletin* so as to bring them under the notice of many in this country who take an interest in the welfare of this portion of our Colonial Possessions.

I have, &c.
(Signed) D. MORRIS,
Assistant Director.

John Bramston, Esq., D.C.L., C.B.,
Colonial Office, S.W.

CCCXXVI.—MISCELLANEOUS NOTES.

Stapelias.—The collection of Stapelias formed by the late Mr. Thomas Westcombe, of Worcester, has recently been presented to Kew by his sister, Miss Westcombe, along with numerous notes, descriptions, and a collection of beautifully executed coloured drawings, prepared by Miss Westcombe from the plants (of *Stapelia* and allied genera), flowered by her brother. Stapelias are exceedingly difficult plants to cultivate, and many of the species can only be kept through an English winter with the utmost care and attention. Mr. Westcombe's success as a cultivator of these plants was quite exceptional. Since his death some of the plants have somewhat suffered, but most of them will probably recover in their new quarters at Kew.

Hippeastrum procerum.—This is the blue Amaryllis of horticulturists, and the Amaryllis Rayneri of *Botanical Magazine*, t. 5883. It was introduced by M. Binot from South Brazil about 1863, but it has remained rare in cultivation, probably on account of the difficulty experienced in getting it to flower. Two plants of it are now in flower in the Succulent house (No. 5) at Kew. The species is quite distinct from the rest of the genus, the bulb having a neck 18 inches long and distichous falcate ensiform leaves, firm in texture, with a white cartilaginous edge. The flowers are borne in an umbel, and they are as large as the Belladonna lily. The colour is bluish-lilac with numerous spots of a darker shade of purple.

Sansevieria Kirkii, Baker.—This plant was described in the *Kew Bulletin*, May, 1887, in a paper on BOW-STRING HEMP. It was sent to Kew in 1881 by Dr., now Sir, John Kirk, having been found growing on the mainland opposite the island of Zanzibar. Some of the leaves on the plants received at Kew were 9 feet long. Sir John Kirk wrote that from the length and quality of the fibre of the leaves "it is a plant worth being introduced to our tropical colonies." A sample of the fibre prepared by Death's fibre machine was reported by Messrs. Ide and Christie to be "A very bright, clean, strong fibre, and in every way a most "desirable commercial article. It would compete with the best Sisal "Hemp for rope-making purposes. Value 30*l.* per ton." The plant has been propagated at Kew, and distributed to various colonies both east and west. From its behaviour under cultivation here it is probable that the leaves take several years to grow to their maximum length. There is an example of the plant now in flower in the Palm house at Kew, from which a figure has been prepared for publication in the *Botanical Magazine.* It may not be generally known that small pieces of the leaf of any species of *Sansevieria* will strike root and form plants.

Hanbury Medallion.—The museum of the Royal Gardens has lately become possessed of a medallion portrait of the late Daniel Hanbury, F.R.S., F.L.S. This medallion is the original model in plaster by the late Thomas Woolner. R.A., and was copied in marble for Mr. Thomas Hanbury, F.L.S. It is a faithful likeness of the great pharmacologist. The ornamentation on the flat surface surrounding the portrait represents the plants to which Daniel Hanbury gave special attention, namely, *Liquidambar orientale*, Mill, which he proved in 1857 to be the source of Liquid Storax, and *Ipomœa simulans*, a species of his own, and described by him in a paper read before the Linnean Society in 1869 as the source of Tampico Jalap. Kew is indebted to Mrs. Woolner for the gift of this medallion, which finds a fitting home in a museum greatly enriched by numerous contributions of vegetable drugs made by Hanbury himself during his lifetime.

A Synopsis of the Museæ.—Mr. J. G. Baker, the Keeper of the Herbarium, is the author of a monograph of this small though interesting group, which has lately been published in the *Annals of Botany*, 1893, pp. 189–222. The group stood greatly in need of revision, and this has now been done with the materials of the Kew, Calcutta, and British Museum Herbaria as a basis. The Genera are: *Heliconia*, having 29 species; *Strelitzia*, 4 species; *Ravenala*, 2 species; and *Musa*, 32 species. The new species are two of *Heliconia* and four of *Musa*. An economic point of importance elucidated by the late S. Kurz is repeated here. Concerning *Musa acuminata*, Colla, Mr. Baker writes: "Kurz, " who has studied this species carefully on the spot, says that a large " proportion of the Bananas which are cultivated in the Malay Archi- " pelago are derived from it, and that its best varieties are superior to " all those derived from *M. sapientum*, in quality and delicacy. Typical " *M. acuminata* is wild and has fruits full of seed. From this, several " seedless cultivated varieties are immediately derived, differing in the " colour of the leaves and fruit. They all have the leaves glaucous " beneath, and in one form the waxy bloom is so copious that torches " are made from it."

Flora of Mount Kini Balu.—The collection of dried plants from the above locality in N. E. Borneo, referred to in the *Kew Bulletin*, 1892, p. 249, has been worked out by Dr. O. Stapf, the Assistant for India at the Herbarium, who read a paper on the subject before the Linnean Society on the 15th June last, which will probably appear in one of the society's publications. In addition to the plants collected by the Drs. Haviland, Dr. Stapf, has also taken up a small collection from the same mountain, made by Sir Hugh Low some 40 years ago, together with a few plants collected more recently by Mr. F. W. Burbidge. Altogether they number about 400 species, 320 of which are phanerogams. There are two new genera and upwards of 150 new species, for the greater part shrubs. Melastomaceæ and Rubiaceæ largely predominate in the lower elevations, and the last family is somewhat numerously associated with increasing numbers of Ericaceæ, Vacciniaceæ, Orchids, and ferns at higher levels. Noteworthy among the novelties are 11 very distinct new species of the ericaceous genus ***Diplycosia***, and two new species of the Australian irideous genus ***Patersonia***. Many other new facts have been brought to light by the combined collections, and Dr. Stapf's paper promises to be of more than ordinary interest.

Jodrell Laboratory.—The following work has been done at the laboratory since the appointment of the Honorary Keeper, Dr. D.H. Scott, F.L.S., who entered on his duties in September, 1892 (*K. B.*, 1892, p. 245) :—Prof. J. R. Green, F.L.S., of the Pharmaceutical Society, has been occupied, since the autumn, with an investigation of vegetable ferments, especially those occurring in pollen, and in insectivorous plants. His inquiry is still in progress. Miss Ethel Sargant has carried out in co-operation with the Hon. Keeper, an investigation of the pitchers of *Dischidia rafflesiana* (*see K.B.*, 1892, p. 284, also *K.B.*, 1893, p. 113, and *Annals of Botany*, vol. vii., June, 1893). Mr. G. Massee has worked out, in the laboratory, the life-history of *Trichosphæria Sacchari*, nov. sp. an ascomycetous fungus parasitic on the sugar-cane. Dr. A. de Wévre, of Brussels, worked for a few weeks on the comparative histology of various species of ***Piper***, with a view to the readier identification of the true ***Piper Cubeba***. Professor R. J. Harvey Gibson, F.L.S., of the University College, Liverpool, spent some weeks at the laboratory, carrying on his investigation of the comparativeanatomy of the genus ***Selaginella***, an inquiry for which the Kew collections afford special facilities. Dr. W. C. Williamson, F.R.S., and the Hon. Keeper, have been engaged at the laboratory in the joint investigation of the histology and morphology of fossil plants of the coal measures, commencing with the Calamites and their allies. For the purposes of this inquiry a portion of Dr. Williamson's collection has been temporarily brought to the laboratory. This work is in active progress. Mr. George Brebner is now employed at the laboratory in making drawings to illustrate this investigation. The Hon. Keeper has further been engaged in anatomical researches, on ***Gunnera***, ***Equisetum***, and other genera.

The late Keeper of the Herbarium and Library.—It will be remembered that Professor Daniel Oliver, F.R.S., keeper of the herbarium and library, retired from that office on the 31st May 1890, after more than 30 years service. The Board of her Majesty's Office of Works placed on record its high appreciation of the valuable services rendered to the Royal Gardens by Professor Oliver and bore testimony to " the distinguished ability which he had brought to bear upon the " work of his department . . . his labours contributed largely to gain " for the establishment at Kew that high position in the scientific world " which it deservedly enjoys." In 1884 the Council of the Royal Society had already awarded to Professor Oliver the Royal Medal. It is a pleasure to record that at the Annual Meeting on May 24, 1893, the Linnean Society awarded to this distinguished Botanist its Gold Medal. In handing the medal to Professor Oliver, the President, Professor Stewart, made the following speech, for which we are indebted to *The Journal of Botany* (1893), p. 193 :—

"On handing you the gold medal of the Linnean Society, it is my pleasing duty to recall to the memory of the fellows present, though only shortly and imperfectly, some of the more interesting and important of your labours in botany; those more particularly which have induced the society to confer this medal upon you. First I would call attention to the very wide character of your botanical work. In 1850 you discovered, in Connemara. *Naias flexilis*, a genus new to the British flora. In 1859 you published, in our *Transactions*, a paper on the structure of the stem of *Caryophylleæ* and *Plumbagineæ*, illustrated with plates drawn by yourself; and in 1862 you contributed to the *Natural History Review* a memoir on the structure of the stem in Dicotyledons, with a critical bibliography of the subject. Then, in your series of 18 papers in the *Journal* and six in the *Transactions* of this Society, you turned to systematic, morphological, and geographical botany. These papers relate to all branches of phanerogams; there are several illustrating the flora of tropical Africa, including the whole of the 29th vol. of our *Transactions*, with its 136 plates; and you paid detailed attention to the Loranthaceæ, the Utricularieæ, the Hamamelideæ, and the Olacineæ, your artistic talents enabling you to illustrate beautifully and accurately these memoirs. The second point I would mention is the high excellence of this work. The investigations of more recent workers have confirmed, almost without exception, the accuracy of your observations and conclusions regarding the new genera and species established in these memoirs and elsewhere, notably in the *Icones Plantarum*, which you have now edited for three years wholly yourself. Thus also, in 1862, when geologists were discussing the Atlantis hypothesis, you showed in your paper in the *Natural History Review* that the botanical evidence was against that hypothesis, but that a close connection existed between the flora of tertiary Central Europe and the existing floras of Japan and the United States. The subsequent progress of geological discoveries has proved the soundness of the views advanced in your contribution to the controversy thirty years ago. The third point—and I desire to impress this on the members of the Society—is that much of your work is as yet unpublished; it is enshrined in the Kew Herbarium, where it has contributed largely to Bentham's and Hooker's *Genera Plantarum*, and to numerous memoirs which have been prepared wholly or in part at Kew. The last point I need touch upon is your educational work. Your *Lessons in Botany* is the most useful elementary book we have; your *Illustrations of the Natural Orders* and your guides to the museum and gardens at Kew have been eminently useful in spreading among the people an interest in Botany, and have led many to further study. As Professor of Botany for 30 years in University College, London, you have trained many pupils, now highly distinguished—not least among these being your successor in the professorial chair. With every good wish I hand you the gold medal of the society."

Plants and Excess of Moisture.—Some of the injurious effects of the severe floods that occurred lately in Queensland have already been noticed (*Kew Bulletin*, 1893, p. 147). Other injuries to plants were also felt, due, it is supposed, to the saturated condition of the atmosphere extending over a period of several days. In a note appended to the *Transactions of the Queensland Acclimatisation Society*, 1893, p. 40, Mr. William Soutter states that while numerous plants were destroyed in the Botanical Gardens at Brisbane owing to being submerged in flood water for nearly 10 days, others not submerged were affected "from prolonged exposure to a moisture-laden atmosphere." The leaves of the scented Verbena (*Lippia citriodora*) and of the common garden geranium "presented an appearance of being partially boiled or scalded." A plant of *Sechium edule* was "even more strikingly affected." The old and young leaves and even the stem were alike injured. Mr. Soutter adds:—"In proof of the moist humidity of the "atmosphere between the dates before mentioned, a mulberry tree near "the back entrance to the gardens put forth from the upper branches "clusters of adventitious roots to a length of several inches. An old "plant of *Cocos plumosa* sent out all round the base a perfect cordon of "rootlets about three-eighths of an inch in diameter and from four to "eight inches long. A bamboo shoot from the 30th January to the "6th February grew a height of eight feet five and three-quarters of "an inch, or at the rate of nearly 17 inches a day. This growth was "exceeded by the growth of an aerial root of *Vitis pterophora*, which in "48 hours grew a rootlet of 39½ inches in length, but considering that "this was only one-eighth of an inch in diameter, it does not represent "such a mass of growth as the bamboo with its diameter of about three "inches. Many other plants have made great growth during the "period before mentioned. Crotons have grown several inches, as also "Coleus and other heat and moisture loving plants."

Garden Party at Kew Palace.—On June 17th, by permission of Her Majesty the Queen, the First Commissioner of Her Majesty's Works and Public Buildings and Lady Constance Shaw Lefevre gave a large garden party on the lawn and the reserve part of the Royal Gardens adjoining Kew Palace. The host and hostess, accompanied by about 200 guests, arrived at Kew by special steamers from the House of Commons Pier. More than a thousand people thronged the grounds by five o'clock to meet the Duke of York, the Duke of Cambridge, the Duke and Duchess of Teck, and Princess May. According to the *Times* the guests included the Maharajah of Bhavnagar, the Thakore Sahib of Gondal and the Maharanee, the Rajah of Bobbili, the Austrian Ambassador, the Italian Ambassador, Prince Louis Esterhazy, Earl and Countess Stanhope and Lady Katherine Stanhope, the Earl of Perth and Lady Edith Drummond, the Earl and Countess of Ducie, the Earl and Countess of Denbigh, the Earl of Dysart and Lady Huntingtower, the Countess of Crawford and Lady Evelyn Lindsay, the Earl of Carlisle, Countess Waldegrave, Viscountess Hampden and Hon. Miss Brand, Viscountess Wolseley and Hon. Frances Wolseley, the Bishop of Gloucester and Bristol and Mrs. and Miss Ellicott, Lord and Lady Coleridge, Lord and Lady Esher, Lord and Lady Playfair, Lady Frederick Cavendish, Lord and Lady Wantage and Lady Jane Lindsay, Lord and Lady Walter Gordon Lennox, the Earl of Darnley and Ladies Bligh, Lord Acton and Hon. Miss Acton, Lady Carew, Lord and Lady Wynford, Lord Roberts, V.C., Hon. Lady Ponsonby Fane, Lord and Lady Chelmsford, Lord Monkhouse, Lord Sackville and Miss Sackville West, Lord and Lady Morris and Miss Morris, Sir Algernon Borthwick, M.P., and Lady Borthwick, Sir Joseph Dalton Hooker and Lady Hooker, Sir Richard Temple, M.P., and Miss Temple, Sir G. Trevelyan, M.P., and Lady Trevelyan, Sir Richard Quain, Sir John Mowbray, M.P., Sir John Pender, M.P., the Speaker, Mr. and Mrs. H. M. Stanley, Mr. Frank Lockwood, Q.C., M.P., and others. After the garden party many of the guests visited the conservatories and collections in the Royal Gardens.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 80.] AUGUST. [1893.

CCCXXVII.—ST. VINCENT ARROWROOT.

About three years ago, at the request of the Government of the Windward Islands, a somewhat exhaustive inquiry was undertaken at Kew into the circumstances of the arrowroot industry at St. Vincent. Arrowroot, next to sugar, has been a staple article of export from this interesting island. In fact St. Vincent arrowroot forms one of the principal sources of supply of this well known article of food, and, until about three or four years ago, its production supported a fairly prosperous industry. In 1889 the Honourable Sir Walter Hely-Hutchinson, K.C.M.G., Governor-in-Chief of the Windward Islands, was struck by the depressed condition into which it had fallen, and, with the energy and enterprise which characterised his administration, he sought to trace the causes which had led to the decay of an industry that hitherto had been a source of wealth to the island.

The appeal to Kew was supplemented by so complete a supply of information and material on which to base an inquiry that no hesitation was felt to do what was possible in the matter. Such an inquiry was also in harmony with the aid that Kew had always freely placed at the disposal of such of Her Majesty's Colonies as required it, and especially under circumstances of depression that inevitably follow the temporary or permanent decay of local industries. The result of the investigation undertaken by Kew in the present instance is fully given in the following correspondence. This correspondence, it may be mentioned, was made immediately available at the time through the *Government Gazette* of St. Vincent, and planters were placed in a position to judge exactly how far the depressed condition of their industry was within their own control and what steps should be taken to bring it back to the prosperous position it had once occupied.

There are reasons to believe that the suggestions made to the St. Vincent planters in 1890 have proved of material service to them. Since 1890 the arrowroot industry has certainly revived, and although much of this revival may have been due to purely accidental causes or to favourable changes in the world's markets, there remains however an appreciable margin of probability in favour of better cultivation and of improved methods of manufacture. For this and other reasons it is desirable to place the facts elicited in the course of the inquiry on record in the pages of the *Kew Bulletin.*

The ADMINISTRATOR, ST. VINCENT, to ROYAL GARDENS, KEW.

Government House, St. Vincent,
February 16, 1890.

DEAR MR. MORRIS,

BY to-day's mail I am sending addressed to you a box containing :—(1.) Samples of manufactured arrowroot. (2.) Samples of the plant. (3.) Samples of the soil. (4.) Description of the mode of cultivation. (5.) Description of the mode of manufacture.

These have been selected from the three best arrowroot estates in the island, viz., "Fancy," "Owia" and "Wallilabo."

Sir Walter Hely-Hutchinson asked me to forward the above to you by this mail, saying he was writing to you to find out whether anything could be done to place the St. Vincent arrowroot of the better qualities on anything like the same footing as the Bermuda arrowroot.

The description of the mode of cultivation and manufacture at the Wallilabo Estate you will find inside the tin box containing the sample of arrowroot from that estate. I enclose in this the bill of lading for the box.

I remain, &c.
(Signed) IRWIN C. MALING.

D. Morris, Esq., M.A., F.L.S.
Royal Gardens, Kew.

ARROWROOT CULTIVATION.

The following particulars respecting the cultivation of arrowroot in St. Vincent have been furnished by the managers of Fancy and Owia estates in that Island :—

FANCY ESTATE.

Cultivation of Arrowroot.—The land is cleaned of bush and weeds by burning or burying them. Then holes are made with the hoe, about 4 inches deep and 8 inches apart, and a piece of root, two or three joints, put in each hole. As soon as the roots commence to grow and the leaves appear above the surface the land must be carefully weeded with a small hoe. This to be repeated in about five or six weeks; if the weeds grow rapidly it should be done sooner. In good soil three weedings are sufficient. When the leaves get yellow and the stalk falls, which will happen in from 10 to 11 months after being planted, the roots are fit to be dug.

OWIA ESTATE.

Arrowroot Cultivation.—Arrowroot requires some care in the selection of the land intended for planting, loose or sandy soils apparently suiting it best, though there are districts in which the soil is most undoubtedly clayey producing fairly good results in its cultivation.

New land would be cleared by having the trees cut down, the underwood, bush, &c., if heavy and plentiful, heaped and burnt, the heavy trunks being left to rot or made into charcoal, some trunks at Owia are visible which must have been felled 20 odd years ago.

The land is next ploughed, or more correctly speaking, "hoed up," no other implements being used but hoes ; the product of the cutting and burning (any charcoal made having been removed for sale first) is buried in, and the "bits" or top joints of the tuber are lightly buried in, in rows about 6 inches apart. Roots (as the tubers are here called) which have been about a week dug are found to be best for planting.

The time of planting depends very much on the exigencies of the estates; lands in an established estate are planted to "come in" or be ripe for reaping at such time as the already established cultivation would allow of being manufactured without damage to either. Here, of course, comes in a difficulty for the planter; a very dry season will bring all his arrowroot ripe together about January or February, and out of a cultivation yielding 700 barrels he can only manufacture 125 barrels per month, hence a good deal of his crop has to be manufactured either before or after it is properly ripe.

In wet weather, two or three weeks after planting leaves begin to show above ground, three weeks later the plants are sufficiently grown, as are also the weeds, to be weeded, principally by hand by women, whose duty it is to pull up and collect in heaps everything growing which is not arrowroot; certain kinds of weeds have to be loosened with small hoes. Three to four weeks later, by which time it is presumed that all the "bits" which were capable of growing have grown and shown leaves, the business of supplying is performed, that is, spaces where no arrowroot appears are replanted.

About six weeks after being supplied the fields again require weeding, the weeds being left on the surface and the plants lightly moulded up. After this, at intervals as required, the land is weeded, the more quickly the arrowroot grows, and so covers the ground, the smaller the number of weedings being required. After supplying, three weedings are generally sufficient, it being very essential to proper cultivation to keep it free from weeds.

The arrowroot ripens in 10 to 12 months from time of planting, and shows that it is ripe by "falling," that is, the leaves dry and the stalks bend at the root till the whole lies on the ground.

Some fields mature sooner than others, eight months' of growth being in some few places sufficient for maturity, giving, at the same time, a good yield; others, again, take full 12 months.

The arrowroot plant does not require over-much rain, this tending to produce leaves and not root which is what is wanted, and with our seasons the growth appears to continue until the rains stop, the ripening following closely on the cessation of the rains, an early heavy rainfall during, or towards the close of, the dry season materially reducing the yield of arrowroot, on account of the roots "springing" and throwing out young shoots, the roots then containing more water than starch.

The only manure ever used at Owia is farmyard manure, laid on before the land is ploughed or hoed up, and buried in with the ploughing.

The process of reaping is: In fields where there is considerable growth of leaves the stalks are cut down and heaped, and labourers are put in with hoes, who dig out the roots in breadths, each labourer putting the roots dug at one side of his breadth, breaking off the top joints of the roots and burying them in as plants for the succeeding crop. This system of ratooning is allowed to run on, in some cases, 15 and 16 years.

The roots are afterwards measured, collected, and carted to the mill for manufacture. In digging out, everything on the surface is buried in as manure for the next crop.

ARROWROOT MANUFACTURE.

The following account of the manufacture of arrowroot in St. Vincent was contributed by the late Mr. J. W. Macdonald to the *Journal of the Society of Chemical Industry* in 1887. Mr. Macdonald was proprietor of Wallilabo Estate, and one of the most successful manufacturers of St. Vincent arrowroot:—

WALLILABO ESTATE.

(Reprinted from the *Journal of the Society of Chemical Industry*, May 31, 1887.)

Arrowroot (*Maranta arundinacea*) is a native of the tropics. The island of St. Vincent, in the West Indies, has taken the foremost part in its growth and production; a fair quantity is also made in Natal and smaller quantities in India, Fiji, Queensland, and other countries. Formerly, the Bermuda Islands produced a great deal, but, as there is very little arable land and a scarcity of water, and the inhabitants having turned their attention to growing early vegetables for the New York markets, arrowroot is gradually being given up.

Planting.—In St. Vincent the plant grows 2 to 3 feet high. It has a weak fibrous stalk with six to eight arrow-shaped leaves, resembling the leaves of the lily. When the root is ripe, these leaves fall and wither. The plant flowers but does not bear seed, and is therefore propagated by the root. This can be done in two ways, either by pulling the green stalks, trimming off the long hairy roots, and setting them 6 inches apart in fields previously prepared for their reception, or, as is most generally done, by returning to the soil the upper end of the root, which is hard and fibrous and contains very little starch. As the fields are dug up, the labourers pick out the roots and break off these top pieces four to six inches long returning them to the soil. In this way reaping and planting go on simultaneously. Care must be taken, however, to avoid returning to the soil small thin weak roots. The roots commence to grow in about a fortnight, but, to avoid choking the fields, have to be weeded two or three times. In about 10 to 12 months the roots are ripe, and are then 12 to 18 inches below the surface. If they are reaped before being properly ripe, the next crop suffers and frequently takes 15 months to mature, and the fields require to be frequently weeded. With careful attention and manuring, fields will produce crops continually. The arrowroot is a very hardy plant, and will continue to grow up and die down for years after its cultivation has ceased in a field. The roots are long and tap shaped, and are jointed at intervals of ¾ to 1 inch. In the soil they are protected by a fibrous covering which grows from each joint, the folds overlapping each other to the end of the root. Full grown roots are from 10 to 18 inches long, the most starch being found in the lower or younger end.

Manufacture.—The first part of the manufacturing process is to soak the roots in water to soften the covering and the adhering earth. They are then stripped of the covering and washed, and thrown into a second or rinsing tank. When thoroughly clean they are taken to the pulping machine. The skin is said to contain a resinous matter, which gives a yellow tinge and unpleasant flavour to the starch if the latter is not well washed. In former times the roots were very carefully skinned with German silver knives before being pulped. This is said to have produced whiter starch, but as it was so laborious and expensive, it was discontinued. The skinned roots were pulped by subjecting them to great pressure by passing them through an upper, and then a lower and much closer, pair of polished brass rollers, to break the starch cells. The method of pulping now generally adopted is to feed the clean unskinned roots against a fine saw grater very similar to a potato grater. It is a solid cylinder of hard wood about 23 inches diameter and 7 inches wide. Slits are made by a saw from end to end of the wood at ½-inch intervals. Saw blades having six to ten teeth to the inch are then fitted into the slits, and the whole immersed in water to swell the wood and fix the saws. The grater is now fitted into its place very close to a wooden feeding bed. As it revolves several hundred times per minute it tears the roots into shreds. A great deal, however, depends on the fineness of the teeth and the velocity of the drum.

On account of the very fibrous nature of the pulp, there is considerable difficulty in the sieving or separating the starch from it. The fibres readily gather into lumps and enclose the starch, so that hand sieving, although very tedious, has to be resorted to. The pulp is first run into a box or sieve, the bottom of which is a sheet of copper or tin punched with holes about ⅕-inch diameter. While water flows on, the contents are kept thoroughly agitated by hand, until all the starch has been washed out. While one strainer full is being washed another is being filled, so that there should be no delay. However careful one is, there is a loss of starch in the fibre owing to the presence of small bits of the roots which have escaped pulping.

In one factory, instead of the above strainer a tin-lined copper cylinder has been tried. The cylinder was stationary, its under side being pierced with holes, and inside paddles or beaters revolved at great speed amongst the pulp and water, until the latter flowed away free from starch. The washed fibre was then removed and a fresh charge of pulp put in. This, however, has been discontinued. In another factory, a half cylinder, also stationary, is in course of erection. Its under side is also pierced with small holes, but there is a slide under this to open or close at will. Inside, there are rakes attached to two shafts, which move in opposite directions, and cause the rakes to oscillate very rapidly between each other, thereby keeping the fibre always open. The starch water is let out, more water run in, and the operation repeated until the starch has ceased; then the fibre is taken out. The great objection to any mechanical washer is the tendency of the fibre to accumulate on the agitators and break them. I do not know at present of a single mechanical washer being in use. To get over this difficulty, it has been proposed to chop up or slice the roots into small short pieces, and either rasp them or pass them through metal rollers or mill-stones, so that the thin disintegrated pulp may flow over mechanical sieves. I do not know if this plan has yet been tried. Although causing a loss of starch, the present method of rasping avoids an undue pulverising of the soft yellow fibre, and so gives a very white starch without much further trouble.

From the fibre strainers the starch water flows consecutively through a series of brass wire sieves of 40, 80, and 100 meshes; each of these retain small fleshy bits of unpulped root. From the last sieve the water runs into the settling cisterns, which are preferably lined with white glazed tiles to avoid accumulation of slime.

A portion of the fibre collected on the finer sieves, and also the coarse fibre, is used for feeding the animals on the estate, the remainder and all the coarse fibre are used as manure. For this purpose it is left in heaps until it decomposes, after which it is distributed on the fields along with pen manure. Sometimes also ashes and guano are used. The waste water from washing the starch contains a considerable amount of vegetable matter, and gives good results where it is run on the fields, but the extensive application of this is not practicable. After the starch has settled in the cisterns, the water is run off and more added, the whole is stirred up (optional) and again allowed to settle. This generally suffices to dissolve out soluble matters. At night all the cisterns are drained, and the starch is dug out and taken to a mixing box, where it is mixed with about twice its volume of water, then run through another fine sieve into the separating pans. These are small round galvanised cisterns with smooth perpendicular sides. When filled, the starch milk is stirred round with a round stick until it is in violent circulation. The stick is withdrawn and the cisterns left until morning. The stirring has the effect of separating the starch from any remaining impurities. These, being of less specific gravity, settle last, and therefore on top of the starch. Next morning the water is drained off, and the light impure starch scraped off the surface. If the earlier parts of the process are carelessly done, this separation may have to be repeated before the starch is quite pure. Even should the separation be perfect, re-washing is beneficial for further removal of vegetable matter. The impure surface starch contains a large proportion of starch entangled in very fine particles of fibre and broken cell walls. Although this can be dried and exported as an inferior starch, it is generally given to the labourers as a perquisite. It is used in various forms as flour. Poultry and pigs are also fed with it. Weak caustic soda extracts a colouring matter from it, but also precipitates a yellow substance, making it very difficult to separate the starch from it in a pure state.

The pure starch in the separators is now taken out in blocks, and placed on trays for about 12 hours to drain and harden. It is then broken into smaller pieces, and taken to the drying house, where it is air dried. This building is open on all sides for free circulation of air. It is surrounded, however, with galvanised wire to keep out the small birds which hover about. Inside there are wire shelves over large shallow wooden trays. The wet lumps of starch are placed side by side on the top shelf, where they remain, until by the action of the air they crack up and fall through on to the next shelf. In time, the whole falls through the lowest shelf, and is in a fine granular state, ready for packing. It contains from 14 to 17 per cent. of water. In cold, wet weather, the starch dries very slowly, taking sometimes as long as two weeks. During this time, if the starch has been imperfectly purified, or placed too close on the wires, the lump gets sour, and becomes yellowish. Indeed, the whole process must be as rapid as possible. In the settling cisterns especially, if the starch is left in contact with the impure water too long, its whiteness is affected, fermentation having taken place. The crop lasts from October to May. The name "arrowroot" is, I think, derived from the Indian word, Ara-ruta, or " mealy root," but some say that this root has been confounded with the *Alpinia Galanga*, which was called the arrowroot on account of its bruised roots being used as an antidote to the poison of the *Jatropha Manihot*, which was used for poisoning their arrows. I may say that tapioca starch is obtained from this poisonous root. The poison, however, is contained in the juice only, and is destroyed by heat.

Yield.— Regarding the yield of arrowroot, an acre will produce 13,000 to 15,000 lb. of roots, according to the season ; in wet seasons the roots are heavy and moist, and give less starch. A fair average yield is 22 cwt. air-dried starch, with 14 per cent. water, per acre, or about 19 per cent. on good roots. I have no doubt that this will be considerably increased by the use of much-needed improved pulping and sieving machinery.

Chemical Composition.—The roots that I have analysed got slightly dried in transit, so that they show a rather high amount of starch. The analysis, however, will give an idea of the constituents of the roots. In some respects it differs from an analysis by Benzon, stated in Ure's Dictionary, and which I append:—

—	J. W. M.	Benzon.
Starch	27·07	26.00
Fibre	2·82	6·00
Fat	0·26	0·07
Albumin	1·56	1·58
Sugar, gum, &c.	4·10	0·60 (Gum)
Ash	1·23	0·25 ($CaCl_2$)
Water	62·96	65·50
	100·00	100·00

The ash consisted of phosphate of lime and alkaline sulphates, and chlorides.

I have made an attempt to introduce the residual coarse fibre as a raw material for paper manufacture, but consumers say that it is too weak, and lacking in tenacity. For paper making the starch still remaining could be recovered by steeping in boiling water, and used for sizing the finished paper.

Owing to the fall in the value of sugar, the production of arrowroot in the West Indies has been extended rather beyond the demand. The wholesale price has consequently fallen to an almost unremunerative point. This low price, however, will permit it to be used for whatever purposes the commoner kinds of starch are now employed. In some respects it is superior to common starch, and one of my chief objects in writing this paper is to draw the attention of large users of starch to this comparatively new source of very fine starch. Arrowroot swells much more readily and with less heat than maize, rice, or wheat starch, and forms a stiffer jelly. It is, therefore, highly adaptable for sizing and laundry purposes. I think this property is attributable to the larger size of the granules of arrowroot starch, which are among the largest of the starch granules, whereas the granules of wheat, maize, and rice starch are very small, and will contain a greater proportion of starch cellulose and less granulose, the latter being the substance which swells when dissolved in hot water. Another use for which arrowroot starch is very suitable on account of its great purity and freedom from chemicals, is for the preparation of powder for the skin. Many of the powders sold are composed of very questionable ingredients. Arrowroot well crushed and dried on a plate before the fire is both simple and safe.

It is as an article of food, however, that it has hitherto been mostly used, but the exorbitant retail price put on it (from 8*d*. to 2*s*. per lb.) has kept it out of general use. Of course, being starch, it cannot have the flesh-forming power of flour and other nitrogenous meals, but it is the purest, most digestible and palatable of the starches, and is devoid of the unpleasant taste or flavour observed in potato starch and in the so-called cornflour, and other starches extracted from the cereals by the caustic soda and fermentation processes.

Regarding the annual production of arrowroot, I have not been able to obtain many statistics. Bermuda raises only 500 to 700 kegs, so that very little of what is sold as Bermuda really comes from there. Natal produces 2,000 to 3,000 cases, and St. Vincent about 22,000 barrels, 20,000 of which come to England, and most of the remainder is sent to America. The production of other countries is, I believe, very small.

VALUE OF ST. VINCENT ARROWROOT.

Messrs. FERGUSSON and FORSTER to ROYAL GARDENS, KEW.

11 and 12, Great Tower Street, London, E.C.,
March 24, 1890.

DEAR SIR,

WE herewith hand our opinion of the three samples arrowroot, namely, "Owia," "Fancy," and "Wallilabo." The last-mentioned in point of quality we find to be the strongest, and the others, "Owia" and "Fancy," to be about on a par. The marks "Owia" and "Fancy" have been well known on this market for many years, and have borne a great reputation, but during the last few years there has been a considerable falling off in quality and appearance, so much so that they now have reached the low level of inferior brands. In other words, they have lost their reputation.

We remain, &c.

(Signed) FERGUSSON and FORSTER.

J. R. Jackson, Esq.,
Royal Gardens, Kew.

ANALYSES OF ARROWROOT SOILS.

Mr. JOHN HUGHES, F.C.S., F.I.C., to ROYAL GARDENS, KEW.

Analytical Laboratory, 79, Mark Lane, E.C.
June 27, 1890.

DEAR SIR,

I HAVE now the pleasure of sending you the results of my examination of the 10 soils referred to in your letter of the 4th instant.

In general composition these 10 soils appear to be so similar that it will not be necessary for me to refer to them under separate reports. On analysis they are found to be singularly poor in *nitrogen*, *phosphoric acid*, and *potash*. They are, further, of a very siliceous character, and possess small retentive properties, so that, under the influence of a stimulating climate, they would naturally suffer from exhaustion, and require manure if the crops grown were likely to require a generous supply of the above-named constituents of plant food.

The three specimens marked "Owia" are darker in appearance, and though more stony than those from the other two estates, are yet richer in *nitrogen*, soil No. 2 containing the most, and No. 3 the least. In *phosphoric acid* and *potash*, however, there appears, from the complete analyses made, to be little difference, as the figures for these constituents are remarkably close for all three estates. In lime the three soils from "Owia" are all richer,

No. 1	containing	3·175	per cent. of lime.
No. 2	„	3·056	„ „
No. 3	„	2·553	„ „

"Fancy" estate comes next,

No. 1 containing 2·296 per cent. of lime.
No. 2 ,, 1·385 ,, ,,
No. 3 ,, 1·953 ,, ,,
No. 4 ,, 1·665 ,, ,,

"Wallilabo" containing least,

No. 1 containing 1·027 per cent. of lime.
No. 2 ,, 2·296 ,, ,,
No. 3 ,, 1·101 ,, ,,

I do not, however, consider that liming is necessary for any of the soils, and certainly not lime in a free or caustic state, though as finely ground chalk, gypsum, or finely ground bone meal, its application in moderate doses of 3 to 5 cwt. per acre will doubtless be attended with improved crops.

Arrowroot as a crop is not particularly exhaustive of the mineral constituents of the soil, such as phosphoric acid, potash, and lime, and the same remark may be applied to nitrogen, provided that all the pulp and manufacturing residue be returned to the land. Still, with all possible care, there must be a certain amount of exhaustion of the soil going on, which careful cultivation should replace by judicious manuring.

In addition to the application of ordinary farmyard manure, commonly called in the West Indies pen manure (or at least where such cannot be obtained), I would suggest a general manure of the following composition containing per cent. of the following:—

Soluble phosphate of lime (tribasic phosphate rendered soluble by acid) - -	15 per cent
Insoluble phosphate derived from bone flour -	10 ,,
Nitrogen as derived from sulphate of ammonia	2½ ,,
Nitrogen as derived from fish, dried blood, bone meal - - - - -	2 ,,
Potash derived from sulphate of potash -	4 ,,

Such a manure can be obtained in London for about 8*l*. per ton, and should be applied at the rate of 5 cwt. per acre before the rainy reason sets in.

Believe me, &c.
(Signed) JOHN HUGHES.

D. Morris, Esq., F.L.S.,
Royal Gardens, Kew.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, August 27, 1890.

I AM desired by Mr. Thiselton-Dyer to inform you that there has been forwarded to Kew, at the request of the Honourable Sir Walter Hely-Hutchinson, K.C.M.G., Governor-in-Chief of the Windward Islands, an extensive series of plants and tubers of the common arrowroot, of manufactured arrowroot, of the soils of the principal estates producing arrowroot, and detailed descriptions respecting the methods pursued at St. Vincent in cultivating and manufacturing arrowroot.

2. These specimens were sent with the view of instituting an inquiry into the circumstances which have led to the low prices paid in this country of late years for the best brands of St. Vincent arrowroot, and in the hope that some useful suggestion might be obtained calculated to revive the name and credit of this article in the London market.

3. As the subject was felt to be of considerable importance, steps have been taken to obtain as much information as possible on this side. The plants and roots have been examined, the soils have been analysed by an agricultural chemist, the manufactured article has been submitted to experts for valuation and report, and the methods of cultivating and manufacturing arrowroot pursued at St. Vincent have been carefully compared with the methods pursued in other countries.

4. The general results of the inquiry will be given in detail later. It is well known that the best arrowroot at present in the market is Bermuda arrowroot. This obtains prices more than double, or even treble those obtained for St. Vincent arrowroot. Bermuda arrowroot may therefore be taken as the standard of what a good arrowroot should be, and the circumstances of its cultivation and manufacture are well deserving of consideration.

5. There is no reason to suppose that the arrowroot plants cultivated at Bermuda and St. Vincent differ in any essential respects from one another. Plants have been obtained direct from Bermuda and cultivated in the Bahamas and other islands in the West Indies, and the arrowroot prepared from them according to West Indian methods has been classed as St. Vincent arrowroot.

6. As regards soil, we appear to have no authentic analysis of Bermuda soils. It may, however, be assumed that they have been formed by the disintegration of coral rock, and that they are tolerably rich in lime, phosphoric acid, and other important constituents of plant life. In a recent account of the arrowroot industry in Bermuda (a copy of which is enclosed marked A.), it is stated that "the ground is first well manured and ploughed deep." The advantage derived from such treatment is obvious. The St. Vincent soils, on the other hand, as may be gathered from the analyses furnished by Mr. John Hughes, F.I.C., F.C.S., are "singularly poor in nitrogen, phosphoric acid, and potash; they are "further of a very silicious character, and possess small retentive "properties." It does not appear that manuring is regularly and systematically pursued on St. Vincent estates, and deep ploughing appears to give place to hole digging with hoes.

7. It is impossible to institute a more detailed comparison between the cultural methods pursued respectively at St. Vincent and Bermuda; but enough has been said to show that the advantages as regards soil and culture so far lie with Bermuda.

8. It is probable, however, that the superiority of Bermuda arrowroot depends as much upon the methods of manufacture as on soil and its treatment. In the account of the industry already cited, stress is laid on the fact that "at Bermuda the roots, after being collected, are "washed, and their outer skin completely removed; this operation has to "be performed with great nicety, as the cuticle contains a resinous "matter which imparts colour and a disagreeable flavour to the starch, "which no subsequent treatment can remove." In the accounts given of the manufacture at St. Vincent, it appears that the skin is not always so carefully removed from the roots before they are pulped. One account, however, states that "in former times the roots were very care-"fully skinned with German silver knives . . . but it was so laborious "and expensive it was discontinued. The method of pulping now "generally adopted is to feed the clean unskinned roots against a fine saw "grater, very similar to a potato grater."

9. In other respects, the process of manufacture pursued at St. Vincent appears to be carried on without that scrupulous care and

attention to details pursued at Bermuda. There may also be some difference in the quality of the water employed. The peculiar blue tint noticed in Bermuda arrowroot is said to be due to the use of water from limestone springs. If water from streams or rivers is used at St. Vincent, although wholesome and pure, it may still be capable of giving a dark colour to the arrowroot.

10. It is evident, however, that the present position of St. Vincent arrowroot is only to a small extent due to the character of the water. At one time, when possibly the same water was used, the quality was much better. It is probable that a gradual exhaustion of the soil and a less skilful and a cheaper method of preparation have been the determining circumstances. In any case it is clear, as shown in the report by Messrs. Fergusson & Forster, that " during the last few years there has " been a considerable falling off in quality and appearance (in St. " Vincent arrowroots), so much so that they now have reached the low " level of inferior brands. In other words, they have lost their " reputation."

11. Messrs. Fergusson and Forster are supported in their opinion by other experts to whom samples of arrowroot have been forwarded from Kew. It would be fruitless to dwell any longer on this point. The fact appears to be established that St. Vincent arrowroots in their present condition will only obtain the lowest prices. It remains, therefore, for the planters in St. Vincent to realise the fact, and to make a systematic effort to bring about a more satisfactory order of things. The matter is evidently in a great measure in their own hands, and if they will energetically grapple with the situation there is every probability that they will untimately re-establish the good name of their produce.

12. The hints given by Mr. Hughes as regards the mineral constituents wanting in the soil should receive careful attention. The treatment of the soil might be improved by a deeper and more thorough cultivation. The methods of manufacture pursued at Bermuda might be carefully studied by an intelligent representative of the St. Vincent planters, and every effort made to carry on the manufacture at St. Vincent on the Bermuda lines.

13. These suggestions, and others which will no doubt present themselves to those reading the reports enclosed with this letter, might be placed within reach of all concerned in the arrowroot industry of St. Vincent. Mr. Thiselton-Dyer will be happy to give any further assistance, and it will afford him pleasure to aid the praiseworthy and sympathetic effort made by Sir Walter Hely-Hutchinson to place this industry on a satisfactory footing. The planters in St. Vincent have had numerous difficulties to contend with of late years, but the improvement of an important industry like this is a subject well worthy of their most earnest and careful attention.

I have, &c.
(Signed) D. MORRIS.

Edward Wingfield, Esq., C.B.,
Colonial Office, S.W.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, September 2, 1890.

I AM directed by Lord Knutsford to acknowledge, with thanks, the receipt of your letter of the 27th ultimo, containing suggestions for the improvement of the cultivation of arrowroot in St. Vincent, and to inform you that a copy of your letter, with its enclosures, has been transmitted to the Governor-in-Chief of the Windward Islands.

I am, &c.
The Director, (Signed) Robert G. W. Herbert.
Royal Gardens, Kew.

Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, February 2, 1891.

With reference to your letter of the 27th of August last, on the subject of the cultivation of arrowroot, I am directed by Lord Knutsford to inform you that the Governor-in-Chief of the Windward Islands has requested that his best thanks may be conveyed to you for the care and trouble which you have taken in dealing with the subject.

I am, &c.
The Director, (Signed) Edward Wingfield.
Royal Gardens, Kew.

Disease in Arrowroot.

Curator, Botanical Station, St. Vincent, to Royal Gardens, Kew.

Botanical Station, St. Vincent,
Sir, February 12, 1891.

I have the honour to forward for your consideration samples of diseased arrowroot, locally known as "burnt," but which I think more resembles the growth of a fungus. A short time ago considerable attention was paid by the Kew authorities to St. Vincent arrowroot, and I think it most desirable that this matter should also receive attention. A sample of the soil in which it was grown is forwarded, also a copy of the letter which accompanied it.

I have, &c.
(Signed) H. Powell.
W. T. Thiselton-Dyer, Esq., C.M.G.,
Royal Gardens, Kew.

[Enclosure.]

Sir, St. Vincent, January 26, 1891.

I beg to hand herewith a few roots of arrowroot grown on the Spring Estate, "Leeward," which show signs of mildew or decay, just at the time they are fit to be dug. The labourers refer to them as "burnt roots," but I do not think that any of the effects of heat are traceable upon them.

I would be glad if you could find out for me whether there is any disease, either blight or otherwise, which has affected the roots: the leaves are not at all affected. These roots are met with at irregular intervals in the field, and would form a rather large per-centage on a small cultivation.

I am, &c.
Mr. H. Powell, Curator, (Signed) Alfred E. Lewis.
Botanical Station.

Professor Marshall Ward, F.R.S., to Royal Gardens, Kew.

Botanical Laboratory, Forest School,
Cooper's Hill, March 20, 1891.

My dear Thiselton-Dyer,

The specimens of arrowroot sent are very badly affected with a subterranean fungus-mycelium, which enters the stem and destroys much of the tissue. The black patches in the latter—seen on cutting the stem—are thickly matted mycelium. By cultivation in damp chamber at rather high temperature, I have made the hypha produce conidia, the "Spicaria" form of older systematists, but there is not sufficient evidence to decide finally as to the species, &c.

It is pretty clear that the fungus can spread from one rhizome to another on or below the surface of the soil. From this, and from the information in letter (returned), I should urge the advisability of digging up and burning all affected plants, and this should be done on the diseased spots, so as to bake the soil there.

I am, &c.
(Signed) H. Marshall Ward.

W. T. Thiselton-Dyer, Esq., F.R.S., C.M.G., C.I.E.,
Royal Gardens, Kew.

Royal Gardens, Kew, to the Administrator, St. Vincent.

Royal Gardens, Kew,
March 26, 1891.

Dear Captain Maling,

We lately received through Mr. Powell, Curator of the Botanical Station at St. Vincent, some rhizomes of arrowroot from diseased plants from a Windward estate. The planter who sent them states that the roots "show signs of mildew or decay just at the time "they are fit to be dug; the labourers refer to them as 'burnt "roots.'"

2. As anything affecting your arrowroot industry is of considerable importance to the island, we have had these roots very carefully examined by Professor Marshall Ward, F.R.S., and his report is herewith enclosed. It is evident from this report that the roots are badly attacked by an underground fungus or mildew, and steps should be taken, without delay, to take up all diseased roots and burn them on the spot.

3. When the roots are destroyed in this manner the soil from which they have been taken might be turned over and dressed with lime. The particular spots where the disease has appeared might be left unplanted for a season or two to allow the fungus spores to be eliminated from the soil.

4. These are very simple and practicable suggestions, and those who recognise the presence of the disease on their estates will doubtless take advantage of the information now given to prevent it from spreading to any serious extent.

I am, &c.
(Signed) D. Morris.

His Honour Captain Maling,
Administrator, St. Vincent.

PRESENT POSITION OF ST. VINCENT ARROWROOT.

MESSRS. FERGUSSON AND FORSTER to ROYAL GARDENS, KEW.

13, Great Tower Street, London, E.C.,
14th August 1893.

DEAR SIR,

WE have not hastily replied to yours of the 8th instant, because, before doing so, we were anxious to collect and give you the best information respecting St. Vincent arrowroot. The chocolate and cocoa manufacturers, as you may know, are the great consumers of this article, and coming, as they do, into the market for large quantities they naturally raise prices, sometimes considerably, as it is well understood these purchasers are not re-sellers. On the top of this there is oftentimes a speculative movement, and hence prices are unduly raised. We do not think that there is much chance for any great advance to be expected for some time in the qualities used by the manufacturers. The prices they have been paying of late have been 2¾*d.*, 3*d.*, to 3¼*d.* per lb., the importation being greater than for the last year or two. The good estate growths have fetched 3¾*d.*, 4*d.*, 4½*d.*, and 5*d.* to 6*d.* for choice lots.

We may here mention that recently a parcel appeared upon the market from Grenada which fetched 3*d.* per lb. and was thought equal to the best St. Vincent. We also have information that a much larger quantity is expected from Bermuda shortly. This island has always sent us the very finest qualities, ranging from 2*s.* 2*d.* to 1*s.* 3*d.* per lb., only, however, in small quantities. We heard also that we may expect a good supply from Natal, which a few years ago used to send us considerable quantities and realised mostly higher prices than the best quality of St. Vincent. In conclusion we feel certain that the growers in St. Vincent would do well for themselves if they could manage to send to this market more of the finer grades than they have been doing of late years.

We remain, &c.
(Signed) FERGUSSON AND FORSTER.

D. Morris, Esq., C.M.G.,
Royal Gardens, Kew.

CCCXXVIII.—PULPING LIBERIAN COFFEE.

The cultivation of Liberian Coffee is extending in many parts of the world, especially in Java, the Straits Settlements, and the West Coast of Africa. Information respecting this coffee has been given rather fully in the *Kew Bulletin* (1888, p. 261, and 1890, pp. 107 and 245). In the *Kew Bulletin* for 1892, pp. 277–282, there is given a detailed account, with the actual yield, of several estates in the Malay States, showing that Liberian coffee can be successfully established at elevations much below those suited for Arabian coffee, and further, that crops of 9 to 12 cwts. per acre can be obtained from trees after the third or fourth year. In some countries difficulty has been experienced in preparing Liberian coffee for the market. Inquiry has often been addressed to Kew on the subject, and it is desirable to place on record such facts as have been obtained after careful inquiry amongst persons possessing the necessary experience.

It is well known that when the Liberian coffee is ripe the pulp investing the beans is never soft, as in Arabian coffee. It is generally of a tough fibrous character, and offers considerable resistance during the process of pulping. This circumstance has discouraged many people just starting, and, after vainly trying to overcome the difficulty, they have given up the cultivation of Liberian coffee as impracticable. It would appear, however, that if rightly managed there is no special hindrance to be overcome. The first point to be attended to is to pick the cherries when perfectly ripe, and when brought in they should be passed through a simple machine, called a "sizer," in order to obtain two or three lots of cherries of similar size. Cherries of unequal size cannot be successfully treated. That is well understood by everyone who has had experience with Liberian, or indeed any coffee. When the cherries have been sized they are then to be passed through the "pulper." There are special pulping machines prepared for treating Liberian coffee fitted with an adjustable "breast" suited to different sizes of cherries.

There are other and larger machines, combining both a sizer and pulper in one. A machine of this latter kind, made by John Gordon & Co., of London, is described as follows :—

"The machine is provided with a rotary screen and an elevator ; it is also fitted with a patent adjustable breast, having removable working parts made of steel.

"The hopper is divided into two unequal parts, and the coffee berries are delivered into the larger division with a constant stream of water, the water being absolutely necessary to float the coffee over into the machine and to carry off the pulp and skins. The coffee berries which, owing to difference in size, pass through the machine unpulped are discharged by the screen into the elevator and delivered by it into the smaller division of the hopper, and thence they pass into a separate channel of the breast, which should be adjusted to the size of the berries thus brought into the machine by the elevator.

"The working of the machine is simple, and the only part which requires care is the breast, and if this be carefully fixed and its channels intelligently regulated, no difficulty whatever will be found in obtaining good results, always provided that the coffee be ripe and freshly picked."

A smaller machine, capable of being worked by hand, is also made by the same firm. The makers attach great importance to certain points considered essential in regard to Liberian coffee. These have already been briefly alluded to. They say that "in order to obtain good results, "it is imperative that the coffee be ripe, freshly picked, and fed into "the machine with *a constant stream of water.*"

Further information on the treatment of Liberian coffee is contained in the following correspondence :—

Messrs. JOHN GORDON & Co. to ROYAL GARDENS, KEW.

Dashwood House, 9, New Broad Street, E.C.,
6th May 1893.

DEAR SIR,

WE thank you for your favour of yesterday, and shall be very pleased to forward copies of our catalogue to the addresses you have kindly favoured us with. We have supplied pulpers for Liberian coffee to Java, West Coast of Africa, and mostly to the Malay Peninsula. One firm there, Messrs. Hill and Rathbone, have had six or seven pulpers ; they have also our peelers and separators. You may know that we sent Mr. Hart, of the Botanical Gardens, Trinidad, one of our small pulpers, with which he obtained very good results.

It is quite imperative that water be used in pulping, and where it is not obtainable the only course, we fear, is to dry the coffee in the cherry, when it can very well be peeled, only this takes some power.

Yours truly,
(Signed) JOHN GORDON & Co.

D. Morris, Esq.,
Royal Gardens, Kew.

Messrs. JOHN GORDON & Co. to ROYAL GARDENS, KEW.

9, New Broad Street, London, E.C.,
10th May 1893.

DEAR SIR,

WE are obliged by your favour of yesterday, and we now beg to inform you that our peelers and separators will treat Liberian equally as well as ordinary Arabian coffee, and that as far as these machines are concerned there is no difference in construction. It is only in the operation of pulping where difficulty has been found, necessitating a special pulper.

Yours truly,
(Signed) JOHN GORDON & Co.

D. Morris, Esq., F.L.S.,
Royal Gardens, Kew.

CCCXXIX.—FIBRE INVESTIGATIONS IN THE UNITED STATES.

The annual report upon the fibre investigations undertaken in the United States under the auspices of the Department of Agriculture by Mr. Charles R. Dodge in 1892 has just been issued.

In this report the further explorations in regard to the distribution of plants of Sisal Hemp in Florida are given, together with the results of some experimental operations undertaken to extract fibre from the leaves by means of the Van Buren cleaning machine. Some interesting particulars are given respecting the distribution and possible utilisation of Bowstring Hemp plants in Florida, and an inquiry has been started with regard to extracting commercial fibre from the leaves of the pine-apple plant. It is stated in the report that the United States import fibre from Yucatan and elsewhere to the value of about five million dollars yearly, and as the Florida article is of better quality, it is claimed that it should command a higher price in the market than that from Mexico.

Further, it is pointed out that New Zealand flax is readily grown on the Pacific coast, and could be produced in many other portions of the country. Last year the United States imported 67,000 bales of New Zealand flax, which, according to the report, could as readily be grown in the United States as imported from the Antipodes.

SISAL HEMP.

Experiments in extracting fibre from leaves of Sisal Hemp in Florida were carried on at Cocoa-nut Grove in Biscayne Bay. Here a cleaning factory was established with a Van Buren machine. "The results of " the season's work were in every way satisfactory, and a considerable

" quantity of valuable material in the form of fibre products were " secured, which will enable the Department to test the fibre in " manufacture, and ascertain the facts regarding yield of fibre per ton " (of leaves), tensile strength, and commercial value."

As regards the supply of leaves for these experiments, it is interesting to note that the larger quantity was obtained from the neighbourhood of the original planting of Sisal Hemp made by Dr. Perrine on Indian Key (see *Kew Bulletin*, March 1887, pp. 4, 5; and 1892, pp. 25, 26) nearly 50 years ago. The chief and more important sort found in Florida is the smooth-leaved plant known as *Agave rigida* var. *sisalana*, similar in every way to the Bahamas plant. There is also a sort armed with teeth, called in the report the "spined form," similar to the plant generally cultivated in Yucatan. This is not nearly so widely distributed as the smooth-leaved sort. There is a third sort of *Agave* found in Florida called the "False Sisal." This was described for the first time by Mr. Baker in the *Kew Bulletin*, 1892, July and August, p. 183. The false Sisal (*Agave decipiens*) has shorter and narrower leaves "nearly always rolled in at the sides, so that a cross section " appears like the letter U. In colour it is a brighter, more livid " green." It is said to yield a fibre "greatly deficient in strength."

Mr. Dodge reports that the people in the Bahamas "carried off by " purchase, or otherwise, schooner loads of false Sisal from Florida," for planting purposes. As the fibre from this sort has been found "very inferior, both in quantity and quality," he advises that it should be carefully avoided by those collecting suckers for starting fresh plantations.

Weight of Sisal Leaves.—In a counting of nearly a ton weight of leaves obtained from Indian Key it was found that they gave an average weight of 1·41 pounds (about one pound six and a half ounces) per leaf. "This " average is lower than would have been the case if the cuttings had " been made invariably from old mature plants." Several smaller lots of specially selected leaves from large isolated plants gave the following weights per leaf, viz.:—2·64 pounds; 2·08 pounds; 1·85 pounds and 2·27 pounds. This shows a range from one pound thirteen and a half ounces to two pounds ten ounces per leaf.

Yield of Fibre.—In Yucatan Mr. Dodge estimates that a ton of leaves yields a little over 82 pounds net of dry fibre. In his experiments with the Van Buren machine he found that a ton of Florida Sisal leaves yielded a little short of 79 pounds of dry fibre. He adds that "the " machine made a very considerable waste, which, after being carefully " washed and dried gave [an extra yield] of 22½ pounds per ton of leaves." There are, therefore, at least about 102 pounds of available fibre in a ton of *Agave* leaves, but in this case it was possible only to extract a little short of 79 pounds. In the Bahamas, according to Mr. T. J. MacLain, the U.S. Consul at Nassau, the average yield of 2,000 pounds weight of Sisal leaves is 75 pounds of dry fibre (equivalent to 83 pounds per ton). These several figures will be found useful in regard to future calculations as to the yield of Sisal Hemp leaves. They may be briefly stated as follows:—A ton of green leaves contains, probably, 102 pounds of dry fibre, but so far in actual working the yield has been in Yucatan (with the Raspador), 82 pounds; in Florida (with Van Buren machine), 79 pounds; in Bahamas (no machine stated), 83 pounds. In other words, the yield of fibre as compared with the weight of leaves is approximately as follows:—Highest possible yield, 4·6 per cent.; yield in Yucatan (with the Raspador), 3·6 per cent.; yield in Florida (with

Van Buren machine), 3·5 per cent.; yield in the Bahamas (machine not stated), 3·7 per cent.

It is impossible from the Florida experiments to obtain the actual yield of dry fibre per day of ten hours, or the cost per ton in cleaning the fibre. We gather that "no attempt was made to estimate the cost "of cleaning—the main object being to secure thoroughly well cleaned "fibre without regard to the time occupied in passing the leaves "through the machine."

The Machine Question.—Nothing of a practical character appears to have been accomplished as yet in the United States in securing a thoroughly satisfactory machine for cleaning Sisal leaves. One new machine called the J. C. Todd machine is noticed, and an illustration given. This is supplied with an automatic feeding arrangement, and is apparently of a somewhat complicated character. No facts are given as to its cost, weight, the power required, or capacity. A report on an American machine known as the Weicher machine, now on trial in this country, was published in the *Kew Bulletin* in June last (1893, p. 141).

PINE-APPLE FIBRE.

The pine apple is cultivated in Florida for the sake of its fruit, which is exported to the northern markets. The number of fruits shipped during 1892 amounted to nearly two millions. "The principal plantations on the Keys are found at Elliotts and Key Largo, though "plantations are found to the southward of these for many miles. On "the mainland there are more or less extensive plantations from the "extreme southern portions of the State northward on the west coast "to Charlotte Harbour, and on the east along the Indian River to the "Lake Worth and Jupiter region." Leaves of pine-apple were treated by "the Van Buren machine, which, while it turned out a superb "product, would be wholly inadequate for the work from a commercial "stand point, as only two or three leaves could be fed in at a time." The leaves experimented upon were obtained from plants of the Red Spanish pine-apple. They were cut the day after the fruit was gathered. Many were injured by chafing and bruising. The actual yield from 1,022 pounds of leaves was 25 pounds of fibre thoroughly dry. This would be at the rate of about 55 pounds to the ton of leaves, or 2·5 per cent. nearly; other experiments gave a yield of a little over 40 pounds and 42 pounds respectively of dry fibre to the ton of leaves. "Estimating 10 "pine-apple leaves to the pound there would be over 22,000 leaves to "the ton, which, as we have seen, would produce from 50 to 60 pounds "of dry fibre."

BOWSTRING HEMP.

The principal and possibly the only species of Bowstring Hemp cultivated in Florida is *Sansevieria guineensis*. The plant figured by Mr. Dodge opposite page 373 of his report is what is regarded as the broad-leaved variety of this species. It evidently flourishes with great vigour in Florida, for in the experiments at Biscayne Bay it was possible to select over a hundred pounds of leaves that averaged 6½ feet, and yielding fibre 6 feet in length. In general the leaves varied from 2½ feet to to 7 feet. "Careful estimates based on the quantity of *Sansevieria* fibre "produced in one experiment would give the yield at about 40 pounds "of dry fibre to the ton of leaves. It has been explained that the Van "Buren machine made too large a per-centage of waste. . . . but "with only reasonable wastage the yield of fibre per ton should come

" nearer to 50 pounds." This latter yield would be at the rate of 2·25 per cent. The opinion is expressed that although this is much below the yield of Sisal Hemp, "the quick growth of the plant, the ease with " which it can be harvested and handled, and the higher price of the " fibre, will probably more than make up for the difference in yield of " the cleaned fibre." Full particulars respecting Bowstring Hemp, and the various species of plants yielding it, will be found in the *Kew Bulletin*, May 1887, pp. 1–11.

CCCXXX.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS VI.

5-5112 51. **Euonymus aculeatus**, *Hemsl.* [Celastrineæ]; undique glaberrimus, ramulis crassiusculis cortice flavescenti, foliis longiuscule petiolatis crasse coriaceis flavescentibus lanceolatis vel oblanceolatis acuminatis subacutis basi cuneatis remote minuteque calloso-denticulatis vel infra medium integris costa crassa venis primariis lateralibus utrinque 5–6 petiolo crasso, cymis axillaribus pedunculatis dichotomis ramulis 4-angulatis divaricatis, floribus numerosis tetrameris mediocribus, calycis lobis brevissimis rotundatis, petalis fere orbicularibus brevissime unguiculatis vix undulatis, antheris magnis, filamentis brevissimis supra lobos incrassatos disci insertis, ovario papilloso 4-loculari loculis 2-ovulatis, fructu globoso aculeato, aculeis numerosissimis vix rigidis.

Habitat.—South Patung, Hupeh, and South Wushan, Szechuen, China, *A. Henry*, 5335A and 6143.

Frutex 1–3 pedalis (fide *Henry*). *Folia* 3–6 poll. longa, petiolo ½–1 poll. longo. *Cymæ* circiter 3 poll. longæ. *Flores* 4–5 lineas diametro. *Fructus* immaturus 6 lineas diametro.

Allied to *E. echinatus*, Wall., differing in being of a yellow colour in the dried state, larger thicker leaves on relatively long petioles, almost obsolete calyx lobes and very short filaments.

5-5117 52. **Euonymus cornutus**, *Hemsl.* [Celastrineæ]; undique petalis exceptis glaberrimus, ramulis teretibus graciliusculis lateralibus insigniter divaricatis, foliis breviter petiolatis vix coriaceis lineari-lanceolatis longis longe acuteque acuminatis basi cuneatis minute calloso-serrulatis venis primariis distantibus inter se et cum tertiariis anastomosantibus, cymis 2–3-floris axillaribus, pedunculo elongato pedicellisque gracillimis fere capillaribus, floribus rubescentibus mediocribus sæpius tetrameris, calycis lobis fere orbicularibus margine minute erosis, petalis obovatis intus obscure puberulis, antheris magnis subsessilibus, ovario 4–5-loculari, stylo brevissimo, fructu dorso sursum longe 4–5-cornuto caeterum lævi, cornubus cum placentis alternantibus.

Habitat.—Fang and Chienshih, Hupeh, China, *A. Henry*, 5442A, 5954A, 6815A.

Frutex parvus (fide *Henry*). *Folia* 1–6½ poll. longa, sæpius 3–5 poll. longa, maxima 9 lineas lata, petiolo 1½–3 lineas longo. *Pedunculi* 1½–2 poll. longi, pedicellis 6–9 lineas longis. *Flores* 5–6 lineas diametro. *Fructus* apertus circiter 1¼ poll. diametro.

This species is characterised by long narrow leaves, exceedingly slender peduncles and horned fruit, the horns alternating with the placentas.

5-5279 53. **Euonymus myrianthus,** *Hemsl.* [Celastrineæ] ; undique glaberrimus, ramulis teretibus crassiusculis, foliis breviter petiolatis subcoriaceis lanceolatis oblanceolatis vel interdum obovatis acuminatis et subacutis vel obtusis vel rotundatis basi cuneatis plus minusve crenato-denticulatis, venis primariis utrinque circiter 10, petiolo distincte canaliculato, cymis numerosis confertis breviter pedunculatis multifloris in axillis foliorum superiorum et pseudoterminalibus ramulis divaricatis gracillimis 4-angulatis, floribus tetrameris flavis majusculis, calycis lobis latis rotundatis membranaceis minute paucidenticulatis, petalis ellipticis, antheris magnis subsessilibus, disco lato brevissime cupulari, ovario lævi 4-loculari stigmate subsessili, fructu ovoideo tota longitudine 4-alato.

Habitat.—South Patung and Chienshih, Hupeh, China, *A. Henry*, 5335, 5945.

Frutex vel arbor usque ad 20 ped. altus (fide *Henry*). *Folia* 2–5 poll. longa, sed sæpius 3–4 poll. longa, petiolo 2–3 lineas longo. *Cymæ* circiter 2 poll. longæ et latæ. *Flores* 7–8 lineas diametro. *Fructus* immaturus circiter 9 lineas longus et 5 lineas latus.

This resembles *E. pendulus,* Wall. in the subterminal inflorescence, but the fruit is totally different.

5-5115 54. **Euonymus venosus,** *Hemsl.* [Celastrineæ], undique glaberrimus, ramulis verruculosis subquadrangulatis, foliis breviter petiolatis coriaceis pallidis anguste oblongis anguste lanceolatis vel oblanceolatis subacutis vel utrinque obtusis remote minuteque calloso-denticulatis creberrime venosis venis elevatis insigniter anastomosantibus, cymis parvis paucifloris sæpissime supra-axillaribus, floribus minutis brevissime pedicellatis tetrameris, calycis lobis fere orbicularibus integris, petalis cucullato-orbicularibus venosis, filamentis filiformibus quam antheris longioribus, ovario 4-loculari, stylo brevissimo, fructu sæpius abortu uniloculari lævi pisiformi minimo.

Habitat.—North and South Wushan, Szechuen, and South Patung, Hupeh, China, *A. Henry*, 5778, 7019, 7284.

Frutex 5–8 pedalis (fide *Henry*). *Folia* 1½–5 poll. longa sed sæpius 2–4 poll. longa, petiolo circiter 2 lineas longo. *Cymæ* circiter pollicares. *Sepala* minutissima. *Petala* vix sesquilineam diametro. *Fructus* vix 3 lineas diametro.

A very distinct species, remarkable for the close and curiously anastomosing venation of the leaves.

55. **Ornithogalum (Cathissa) natalense,** *Baker* [Liliaceæ], bulbo ignoto, foliis 2–3 linearibus basalibus suberectis pilosis margine conspicue ciliatis, pedunculo brevi, racemo laxo multifloro, pedicellis brevibus ascendentibus, bracteis e basi lata lanceolatis, perianthio albo magnitudine mediocri segmentis oblongo-lanceolatis exterioribus dorso carina obscura rubro-brunnea trinervata præditis, staminibus perianthio distincte brevioribus, filamentis linearibus conformibus puberulis, antheris parvis oblongis, stylo ovario æquilongo.

Habitat.—Natal, summit of Amanahqua Mountain, alt. 6,800 feet, *J. M. Wood*, 4567.

Folia 3–4 poll. longa. *Pendunculus* 1–4 pollicaris. *Racemus* 1½–3 poll. longus, pedicellis inferioribus 3–4 lin. longis. *Perianthium* 3–4 lin. longum.

Nearly allied to *O. hispidum*, Hornem. (*Anthericum pilosum*, Jacq. Ic. t. 416.)

56. **Asparagus (Asparagopsis) Buchanani**, *Baker* [Liliaceæ-Asparageæ]; fruticosus, late sarmentosus, ramis gracilibus glabris, spinis duris pungentibus subrectis, cladodiis 2–6-nis angustissime linearibus ascendentibus elongatis, racemis copiosis segregatis laxifloris, bracteis minutis ovato-lanceolatis, pedicellis erecto-patentibus flore longioribus apice articulatis, floribus hermaphroditis, perianthio campanulato albo segmentis oblanceolatis obtusis flore expanso patulis, staminibus perianthio æquilongis, filamentis filiformibus, antheris parvis globosis, ovario ovoideo, stylo brevi, stigmate brevissime tricuspidato.

Habitat.—Shiré highlands, *Buchanan*, 757, 1503.

Spinæ inferiores 3–4 lin. longæ. *Cladodia* 8–9 lin. longa. *Racemi* 1½–2 pollicares. *Perianthium* 1 lin. longum.
Nearly allied to *A. racemosus*, Willd.

57. **Polypodium (Phymatodes) dulitense**, *Baker* [Filices]; rhizomate gracili late repente, paleis lanceolatis membranaceis ascendentibus pallide brunneis, stipitibus rigidis elongatis nudis stramineis, frondibus parvis ovatis simplicibus acutis vel acuminatis chartaceis glabris nitidulis siccitate pallide brunneis dimidio inferiori crenatis basi rotundatis vel deltoideis, venis primariis erecto-patentibus parallelis remotis, venulis in areolas hexagonas venulis liberis inclusis anastomosantibus, soris parvis globosis subimmersis.

Habitat.—Mount Dulit, Sarawak, Borneo. Collected by Mr. Chas. Hose. Sent to Kew by the Bishop of Sarawak and Singapore in July 1893 as No. 301.

Stipites 3–5 poll. longi. *Lamina* 2–3 poll. longa, supra basin 9–21 lin. lata.
A pretty little dwarf species, nearly allied to *P. Labrusca*, Hook.

58. **Polypodium (Goniopteris) firmulum**, *Baker* [Filices]; rhizomate lignoso cylindrico nudo late repente, stipitibus nudis elongatis, frondibus oblongo-lanceolatis simpliciter pinnatis firmulis glabris, rachi pubescente, pinnis paucijugis sessilibus lanceolatis acuminatis subintegris basi truncatis vel late cuneatis, venis primariis erecto-patentibus ad marginem parallelis, areolis inter costam et marginem 4–5-seriatis, soris parvis laxe dispositis superficialibus inter venas primarias biseriatis.

Habitat.—Mount Dulit, Sarawak, Borneo. Collected by Mr. Chas. Hose. Sent to Kew in July 1893 by the Bishop of Sarawak and Singapore as No. 295.

Stipites sesquipedales. *Lamina* pedalis vel sesquipedalis; *pinnæ* 3–4 poll. longæ, 9–12 lin. latæ. *Venæ* primariæ 1½–2 lin. inter se distantes.
Allied to *P. urophyllum*, Wall., and the North Australian *P. pœcilophlebium*, Hook. There are traces of a rudimentary indusium.

59. **Polypodium (Grammatis) Maxwellii**, *Baker* [Filices]; rhizomate breviter repente, paleis densis erectis lanceolatis membranaceis pallide brunneis, stipitibus brevissimis nudis contiguis, frondibus simplicibus linearibus integris obtusis firmulis ad basin attenuatis utrinque nudis glabris venis remotis erecto-patentibus furcatis ad marginem haud attingentibus, soris uniseriatis globosis subimmersis laxe dispositis ad costam approximatis.

Habitat.—Mount Guding, Sarawak, Borneo. Collected by the Bishop of Sarawak and Singapore and sent by him to Kew in July 1893, as No. 296.

Lamina 1–2½ poll. longa, medio 1⅓ lin. lata.

Habit of *P. subevenosum*, Baker, from which it differs by its produced forked veins. Named, at the request of Bishop Hose, after the Hon. F. R. O. Maxwell, H.M. Resident at Sarawak, who accompanied him on the expedition when it was found.

60. **Vittaria (Euvittaria) crassifolia,** *Baker* [Filices]; rhizomate breviter repente lignoso, frondibus contiguis sessilibus linearibus percrassis fragilibus glabris nitidulis siccitate pallide brunneis ad basin sensim attenuatis, venulis immersis occultis, soris in frondis marginem immersis ad laminæ partem superiorem solum productis.

Habitat.—Mount Dulit, Sarawak, Borneo, alt. 5,200 feet. Collected by Mr. Chas. Hose. Received from Dr. Hose, Bishop of Sarawak and Singapore, July 1893, as No. 306.

Lamina, 4–5 poll. longa, medio 2 lin. lata.

Combines the thick texture and entirely hidden veins, except the midrib, of *V. sulcata* and *falcata*, with the strictly marginal sori of *V. elongata*. Though so thick the fronds break across very easily. The sori are deeply immersed in the upper part of the frond, and its altered margins enclose them, that of the upper surface projecting a very little beyond that of the lower surface.

CCCXXXI.—HENEQUEN HEMP IN YUCATAN.

The following interesting report on the Henequen hemp industry in Yucatan was published last year by the Foreign Office [F.O., Misc. Series, No. 236, 1892.] It was prepared by Mr. A. Pierce, the Vice-Consul at Merida, and it furnishes data respecting the cultivation and extraction of Henequen (or Sisal) hemp, likely to prove generally useful. The report is reproduced in the *Kew Bulletin*, for the purpose of placing it within convenient reach of many persons in India and the Colonies interested in the subject:—

Question 1.—What is the total present production of henequen in Yucatan, and its probable increase?

It is generally calculated that for the present year, 1892, from January to December, the export of Yucatan hemp will be nearly 350,000 bales, and taking the said bales at about 375 lbs. Spanish each will give a total of 131,250,000 lbs., and this amount comes from 1,312,500 mecates, a Spanish measure of ground of 24 varas square, each mecate giving 100 lbs. yearly, as a general calculation on the basis of 82 plants each mecate. By this means of calculation it is shown that the production of fibre comes from 270 square miles Mexican of land under cultivation, as each mecate of 24 varas square equals 576 square varas;* the said 270 square miles being about 30¼ square leagues. The above data are taken from the best possible source, but cannot be considered as entirely reliable, as there are no means here of proving such calculations; there being probably a third part more land under cultivation of henequen, the product of which will come forward in the course of the next three years, so that it can be considered (although not proved) that there are some 350 square miles of land under hemp cultivation, or, in the opinion of many, the full area that such cultivation will require ; the port of export being Progreso.

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* 1 vara = 2·782 feet.—Ed.

A hemp plantation lasts for some 15 years, as a general calculation on the basis of production, for each mecate, of 100 lbs. From time of planting out of suckers until they produce five years, as a rule, are required. On good land the crop commences in four years or earlier, whilst on rocky ground from six years or more. These calculations are based on the planting out of suckers under the same conditions in both kinds of ground, with plants of from 18 inches to 20 inches long. Hemp planted on fertile land produces less weight of fibre, although it is longer and finer, because on rocky soil the roots run along the surface, instead of penetrating into the ground.

As generally recognised there are seven classes of this agave, of which only two are cultivated, which are easily distinguished and bear their native names, first, "Sacqui," or white hemp, from the fact that the leaves in sunlight appear silvery, the leaves being light green, and second, "Yaxqui," or dark green leaves. The first named is the kind almost entirely cultivated here, there being a very small proportion of the second, and this principally in the eastern part of the State. The remaining classes known are not used, having very small leaves and little fibre.

Although new plants are being continually placed with the old ones, it is considered that no more than the 350 square miles will be cultivated, as old plants are always dying out. The only chance of a larger area coming under cultivation is from immigration, and this is extremely difficult, owing to the great heat of the climate. It is not considered that the utmost production at one time in this State will exceed 400,000 bales to 450,000 bales, of from 350 lbs to 375 lbs., As there are many bales of the first-named weight the proportion of increase will be more or less as follows :—

	Bales.	
1891	310,000	
1892	340,000	*
1893	360,000	
1894	380,000	
1895	400,000	

The above calculations are based on the new plantations that will begin to produce year by year.

It must be borne in mind that the plant here has long, strong leaves with thorns on both edges, and a sharp point at the end of the leaf.

The plants can be produced from seeds, but this system is never used here, being extremely lengthy, suckers being always used.

Question 2.—What is the minimum cost of production, including cost of labour, buildings, machinery, &c. ?

The great increase of expenses in production during the hemp fever of 1888–89, when this fibre reached the fabulous price of 14 c.‡ to 15 c. per lb. (it being calculated that the cost of production, packed and delivered, in the port of Progreso is about 3½ c. to 4 c. per lb.), have been but partially reduced since, so that at the present time it can be calculated that the fibre costs, put in bales and delivered in the port of Progreso, about 4 c. per lb., Mexican money. This is a general calculation, as much depends on the greater or less distance of farms from our port, and the more or less favourable means of transit, and also from the advantages possessed on farms by reason of the number of servants, extent of plantations, &c.

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* The utmost.

† The value of the Mexican dollar fluctuates considerably, but the average value for the year ending March 31, 1892, may be taken at 6 dol. 54 c. to the 1*l*.—Ed.

Question 3.—What is the nature of cultivation, character of soil, and general treatment?

The nature of the cultivation of this plant is very simple. As has been mentioned, the plantations are formed by suckers of from 18 inches to 20 inches of leaf in length planted in straight lines leaving lanes between, usually from east to west, more from custom than any known reason or cause, and, as mentioned, the number of plants in each mecate of 24 varas (Spanish) square is 84, placing each sucker 2 varas from another, or rows of 12 by 7 plants equals 84 plants. Formerly it was the custom to plant only 64 plants in each mecate, but the great increase in this business gave rise to an increase in the number per mecate. The planting of 84 to a mecate is considered the most convenient, both for the working and the growth of the plants.

As before mentioned, rocky ground is the most favourable for this plant, and the only preparation made for sowing the hemp is to clear the ground of trees and plants, the former serving to make charcoal. The first crop sown on the ground so cleaned is maize, this being the quickest crop; this gives time for farmers to rail in their land until hemp is ready to take the place of corn. Here the divisions of farms consist of stone walls, there being always a great supply of stone on the land. Then the plantations are laid out, as mentioned, in straight lines, and with the usual number of plants per mecate, according to the extent of land disposable, and in the most convenient manner for taking the leaves when cut to the cleaning machine. On the majority of farms portable railways have been laid, these being of 50 centimetre gauge, rails 10 lbs. to the foot; the larger part of this material being from the French market, the Decauville system. The Belgians have also sent large quantities of this portable material, rails and sleepers combined costing about 1 dol. 12½ c. per metre.

On most farms the ground is cleared of weeds twice a year, and on others three times, according to the class of ground, means of the farmer, &c. The quick growth of weeds, especially in the rainy season, impedes the due growth of the hemp plants.

There is no fixed rule as to the right time for cutting the leaves, and on this point no certain reason can be given; opinions differ as to the proper time, and the Indian servants only seem to know, when the leaves are ripe for cutting.

As to cutting, the usual custom is to take from each plant, commencing from below, some few leaves in the first year of production, and afterwards some 24 leaves from each plant. If from want of labour the farmer is obliged to cut more leaves from each plant at one time, he tries not to cut more than 12. Too much cutting kills the plant very soon. On the other hand, plants cannot be left without cutting the leaves when ripe, as by cutting the plant continues producing; for it has been observed that plants cut plentifully will last from 15 years to 18 years in continual production.

As soon as the plant produces a long rod from the core, the plant should be destroyed as it no longer gives leaves. The rod flowers and gives seeds, but as mentioned before the latter are not used in plantations.

In order to go on replacing plantations without special expense, and in order not to change the form or work on same, it is the custom to place at the foot of each plant when about three-fourths of its life are spent a small plant, which latter when the old one gives out is ready for production.

There are several opinions as to the best means of planting the suckers. Although in general the suckers are taken from the old plantations and at once placed in new plantations, trials have been made, and with satisfactory results apparently, of leaving the suckers before placing them in fresh plantations in heaps in the open for some two months more or less, placed so as to receive the full heat of the sun on the base of the plant (in form like an onion), from which the roots are taken off. On being taken to new plantations the base is peeled and any dry roots removed, and all dry leaves thrown away. Although the suckers are apparently ruined by this exposure, and for the first two years present a very poor appearance, looking completely dried up, yet in the third year they regain such strength in growing that they then are superior to plants placed out fresh—that is, planted out direct from the old plantation to the new one; and this advantage is seen by their producing more leaves, and those stronger and larger than the other plants. When farms have no old plantations from which to gather the necessary suckers of 18 inches to 20 inches, they are produced by providing space for small plants or seedlings; these are placed in the ground as if they were vegetables, with from 4 inches to 5 inches of leaf, and planted in rows about 3 inches or 4 inches apart, and some 10 inches or 12 inches between each row, the distance being regulated by the size of the plants. On planting out seedlings the roots are taken off. As referred to in making new plantations, it is also convenient to leave these seedlings exposed for some 8 days to 15 days before planting them. They have to be watered now and again, but only sufficiently to keep the ground from becoming too dry. On attaining a sufficient size the plants are passed to new plantations as mentioned above.

Question 4.—What is the machinery used, power required, and quantity of fibre produced per machine per day?

The machinery most generally in use here for extracting the fibre is the rasping wheel, manufactured by Death and Ellwood, of Leicester, England, as also all the other necessary parts completing the apparatus; but for some time since the farmers only buy the principal piece, the wheel which is 40 inches in diameter, 8-inch face, and 1½ inches thick. The great increase in the cultivation of this plant has caused farmers to look for quicker means of extracting the fibre, as many have over-sown, and are unable to attend properly to what they have sown, and the scarcity of labour tends to increase this need; but although much study has been given to the matter, only amongst the larger farmers, who can stand the expense, can new machines be employed such as will compensate for the want of labour. The wheel above mentioned with two men for direct management can clean some 9,000 leaves per day, each wheel requiring about 1½ horse-power English.

For some little time since in some of the very largest farms, the machines known as Prieto, Villamor, and Thebaud have been in use, these three all trying to obtain the first place in the estimation of the farmers.

DATA relating to the Machinery in use in Yucatan for extracting Henequen Fibre, taking as a basis Farms of not less than 1,000 mecates of Hemp under Cultivation.

——	——	Wheels Old Style.	Prieto.	Villamor.	Stephens or Thebaud.
Cost of machine on the farm -	Dollars -	225	6,000	4,000	10,000
Cost of setting up - - -	„ -	25	2,000	1,000	2,500
Horse-power, English, required	Horse-power	1½	16	18	20
Labourers for direct service of machinery.	Number -	3	5	4	5
Leaves cleared, per day of 10 hours.	„ -	9,000	100,000	50,000	100,000
Product of cleaned hemp, good quality.	Per cent. -	90	85	90	80
Product of mixed fibre, or badly cleaned.	„ -	—	10	5	15
Loss of fibre and bark, &c. -	„ -	10	5	5	5

The clean fibre of the machine of Stephens or Thebaud obtains in the United States from ½ c. to 1 c. more per pound than the fibre obtained up to present time from the other machines.

The mixed or badly cleaned fibre is worth from 25 per cent. to 50 per cent. less in value according to class; this class from the Stephens' machine is worth less than like class from the Prieto. Red hemp comes from the well cleaned grade, being stained or dirty, and is sold in this market from 1½ c. to 2 c. per pound less than good cleaned. Red hemp, badly cleaned, is of very little value, and is generally consumed here in rope making or other native industries.

Other machines for fibre cleaning are spoken of, some recently patented, such as Maden, Albee Smith, and R. A. Keene, all of American make. Up to the present the first two named have been tried here, but have not given satisfactory results. It is said that the improvements made in them have been of little account, hence it is not considered that in present form they can compete with the machines mentioned in the present notes.

DATA relating to ordinary Expenses on all Farms, independently of Style of Machinery in use.

Leaf cutter, one man, 200 leaves per day, is paid 25 c. per day.

For carting leaves from plantation to cleaning machinery, done either by tramway or on mule back, it being rare to find farms who do same by carts, as experience has shown that by mules it is more economical, and still more so by tramway, especially on farms of great size.

Four men paid each 50 c. per day of 10 hours can move 120,000 leaves by tramway. One mule can draw one waggon with 3,000 leaves, and make five trips, according to distance, in 10 hours. The mule requires in corn and green food 20 c. daily.

For 10,000 leaves by mules are required 1 driver, whose pay is 37½ c. daily; 5 mules, costing each 20 c. daily.

Each mule carries 200 leaves each trip, so that for a task of 10,000 leaves 10 trips are made.

The men who attend the drying of fibre after extraction, and collect it dry and carry it to press for packing, are paid as follows:—

If the service is done by tramway, one man is required for each 20,000 leaves, and his daily wage is 50 c., and the work is done on small cars drawn by hand.

If the service is performed by hand small boys and men unable to do harder work are employed, calculating one for each 10,000 leaves, they being paid 25 c. daily; this system being much longer in question of time. The man who clears away refuse gains 37½ c. daily.

The engine driver gains from 20 dol. to 40 dol. per month. On large farms a stoker is also employed at 50 c. daily. 1 kilom. of portable railway, of 50 centims. wide and 5 kilos. to the metre, costs, laid down, about 1,400 dol. One platform car for carrying 3,000 leaves costs about 150 dol.

The pressing of hemp fibre into bales is done on the farms by means of lever or screw presses, by hand or by hydraulic pressure. The latter are now becoming general.

The bales vary from 350 lbs. to 400 lbs., some farms going to 450 lbs. but as a medium weight on the entire production a weight of 360 lbs. is used.

The cubic measurement of ordinary bales is about 22 feet; with hydraulic presses, on same basis of 350 lbs. or 400 lbs., about 20 feet per bale.

On most farms the pressing is done apart from other work, and paid for, from 10 c. to 15 c. per bale, according to class of press used. One man can make from 4 bales to 5 bales daily, so that his wage is from 50 c. to 75 c. daily.

The screw presses are American manufacture, and cost from 250 dol. to 500 dol. each. The hydraulic presses are English manufacture, and cost from 3,000 dol. to 6,000 dol., according to size and capacity.

The bands put on bales are made on the farms by farm hands, who are paid from 25 c. to 50 c. daily. Each bale requires from 100 feet to 120 feet of rope, weighing from 3½ lbs. to 5 lbs., for each bale. According to size and weight of each bale from 4 bands to 6 bands are put on each. The cost of bands is about 5 c. each. The bales are sold, including the weight of bands, these being usually made of the inferior grades of fibre.

The marks of bales cost the farmer about 1 c. each, being made from gunny bags.

The cost of administration of farms is calculated from 50 dol. to 100 dol. monthly, according to size. The head servant gains from 30 dol. to 60 dol. monthly, but certain concessions are made him which bring up the amount to the first named sum.

The owner of a farm only treats with the head servant, who renders him all accounts, and this servant attends to all the work, receiving his orders from the owner.

Fuel for engine is wood, obtained from the farm itself. The way of obtaining same is varied, but the general custom is by piecework, of about 75 lbs. to 125 lbs., when wood is dry or wet. This amount is paid for from 37½ c. to 50 c.

Coal is not used on farms, due to the very heavy expenses it incurs from landing in Progreso to a farm, such expenses being some 10 dol. per ton over cost of same in port.

A part of general expenses of a farm are the cleaners or weeders of plantations, and these are paid at the rate of 25 c. per mecate. This cleaning has to be done at least once a year.

Expenses on hemp from farm to port of shipment (Progreso)—a general calculation is 20 c. per 100 lbs.

An export duty (State) is payable on hemp entering Progreso of 15 c. per 100 lbs.

Once in Progreso, charges are :—

Warehouse charges, including receiving, storage for three months, and delivery on pier for shipment, 6 c. per 100 lbs.

Weighing, per agreement, from 2 c. to 3 c. per bale.

Wharf dues, 75 c. per 2,000 lbs.

Lighterage, in native canoes, of from 40 bale to 150 bale capacity, to vessels at anchor, independent of distance, at 30 c. per bale of 350 lbs. to 500 lbs. and 40 c. per bale above 500 lbs.

The customs entries cost about 2 dol. 75 c. per shipment, independently of number of bales shipped.

The foregoing details give all principal particulars relating to machinery employed and the results obtained, as also expenses.

The product of fibre, as above mentioned, is that from 1,000 leaves 50 lbs. of fibre are extracted as a general rule, and according to class, but there are leaves which give up to 100 lbs. per 1,000, this, however, being the exception. From fifth to seventh year of yield of a good plant 75 lbs. per 1,000 leaves can be considered an average yield.

Question 5.—Description of any other appliances used in the cultivation, manufacture, or packing.

The above data and general notes complete the information required under this number.

Question 6.—Principal markets and cost of freight thereto.

The principal markets for Sisal hemp are as follows :—

The United States, principally through New York and Boston. New Orleans is also taking considerable fibre, and there is a probability of Philadelphia being a direct importer.

England, through Liverpool principally.

France, through Havre.

Germany, through Hamburg.

Cuba, by Havana.

Spain, by Seville, Alicante, and Barcelona.

CCCXXXII.—CALIFORNIAN FRUIT INDUSTRIES.

The remarkable development of the fruit industry in California is a matter of considerable interest to those engaged in a similar industry in other parts of the world. In a recent Report issued by the Foreign Office (Annual Series 1893, No. 1251) on the trade and agriculture of San Francisco, by Consul Donohoe, there is given the following account of the present position and prospects of Californian fruit industries :—

San Francisco.

Green fruit sent to England.—During the last season the experiment was tried of sending green fruit direct to London. The time occupied in transit from Sacramento by the first shipment was a little over 14 days, and the fruit is said to have arrived in good condition, having been kept in refrigerators the whole time. It was all sold in a few days, but the prices did not rule so high as had been hoped, and the outcome was unsatisfactory.

Oranges.—The crop of 1891–2 was considerably smaller than that of 1890–91, owing to a destructive wind-storm, which did much damage in Los Angeles and Orange counties, and heavy frosts. Prices ranged low, owing to the generally inferior quality of the fruit. A grave error was made in shipping fruit, damaged by frost especially, to the Eastern markets, which lowered the esteem in which Californian oranges have been held. The overland shipments from six southern counties are estimated at about 3,000 car-loads, against 4,000 for 1891. Oranges are grown in 38 out of the 54 counties of the state.

Prunes.—Early in the spring of 1892 the indications were favourable for a very large crop (expected to reach 40,000,000 lbs.), but, like many other kinds of fruit, the prune was severely injured by the late rains and cold weather, and it is not probable that the season's crop will exceed 20,000,000 lbs. Prices were good except for a short time, when they declined, but soon advanced again, and remained stationary. The acreage planted in 1892 was less than in 1891, owing probably to a growing impression of danger of over-doing the business.

Raisins.—The present season's crop turned out better than was expected, and prices were higher than last year, which was principally brought about by a combination among the growers. There is considerable fear expressed that the business may be overdone, and the new acreage set to raisins was comparatively small.

The imports of foreign raisins into the United States for the years ending June 30, 1891 and 1892, are given as follows:—

Year.	Quantity.	Value.
	Lbs.	£
1891 - - - - -	39,572,655	403,776
1892 - - - - -	20,687,640	192,862

Apples.—Apple-growing is quite extensive in some of the northern counties of the State, and is a more important industry in California than is generally believed.

Figs.—Great interest is being taken in fig-growing and packing especially in the southern part of the State, where large areas of new land have been set to this fruit in the past few years. While the fig as yet does not hold a place of commercial importance in our State, it promises in a few years to take a prominent position among our fruit exports.

Olives.—The olive is another fruit to which great attention has lately been paid. The cultivation of the olive and the manufacture of its oil became of such importance that it was deemed advisable to organise the growers into an association for the advancement and protection of this industry, and an organisation was effected in 1891. The industry is greatly hampered by the adulteration of the oil.

Grapes.—The frosts did a good deal of damage to the grape crop, which accounts for the small vintage for the year. The vineyardists have been discouraged by the low prices for grapes, and the phylloxera has made rapid advances in some parts of the State.

Opinions are divided as to the value of the so-called beneficial insects which have been imported from Australia to prey on those that injure fruit trees.

TACOMA.

Horticultural information.—The State Board of Horticulture have published a very interesting and instructive report relative to the cultivation, care, and treatment of the various fruits, seeds, and plants in this State, which ought to be in the hands of every person who takes an interest in fruit-growing, hops, and gardening. Complete descriptions are given of the pests, insects, and fungi of various kinds which have made their appearance in many of the orchards, hop yards, and gardens of the State, and the remedies most beneficial for their eradication. It contains, besides, papers on the method of growing hops, plant food and fertilisers, irrigation, seed tables, ages for fruit-bearing trees and yields, grafting, waxes, &c.

Spraying is now in common practice, not only in the hop yards, but in the orchards also, and experience has taught all that it is the only way to ensure a crop. There are about 30,000 acres in this State planted with fruit trees, besides small fruits and gardens; half of these trees have been planted only four years, and have not arrived at bearing age, but in the next five years, it is believed, the annual bearing fruit crop will be about 600,000*l.* ($3,000,000), and the hop industry of equal value and importance. It is recommended to divide the State into horticultural districts, with a commissioner for each, who should be a pest inspector for his district, and be responsible for the condition of his district; and also that lectures at various centres should be given on entomology, &c., for the benefit of the farmer and gardener.

Some of the best orchards in the country have been almost entirely destroyed by insects, which spoil the fruit and kill the tree in a short time.

The most destructive pests are the San José scale, the woolly and green aphis, codlin-moth, hop-aphis, the box-elder bug, and caterpillars.

All the land east of the Cascade Mountains, where water by irrigation can be had, if judiciously used, will grow good fruit, and a good portion can be planted in orchards without irrigation; the light, ashy, and sandy soil is especially adapted to fruit cultivation, also to hops and vegetables. It is easily cultivated and very productive. The moisture in many places is kept up by constant cultivation. West of the Cascade Mountains, in the Puget Sound country, the uplands will prove the best fruit lands, especially for apples. The clay loams are good, but not the marshes. No country can surpass this west side for cherries and small fruits, such as gooseberries, currants, raspberries, and strawberries; the latter is the most profitable.

Pruning is done generally just after winter, before the sap starts, and in June.

The market is best generally during the early summer, the late autumn, and winter.

LOS ANGELES AND WILMINGTON.

Fruits are the leading products of Southern California, and heretofore have been almost altogether consumed in the United States, being shipped as a rule overland. There is apparently a surplus for export, which in the near future must be largely increased; but the question whether these fruits or any of them can be profitably disposed of in the English markets, cannot, on account of the great distance and the cost of transportation, be said to be definitely settled. Canned fruits are shipped to England from San Francisco in large quantities, but this portion of the State scarcely enjoys, so far, equal facilities for that trade, and we have only one considerable canning establishment, viz., the Southern California Packing Company of this city, the manager of which, Mr. Welsh, believes that for the present at least he can sell his product to best advantage in the home markets of the United States.

Oranges.—Oranges are our leading fruit. This season's crop, now (March 1893) in process of being marketed, is estimated to amount to 6,000 car-loads, each of 300 70 lb. boxes (about 60,000 tons); and the domestic sale is so far rather slow, on account of the competition of Florida, Mexican, and Sicilian fruit, and of excessive cold weather lessening the consumption in the Eastern States. Within a few years it is believed the crop will amount to 20,000 car-loads, about 200,000 tons, and there is no present visible domestic market for such a quantity. I recently conversed here with Mr. Lawrence Connolly, a gentleman of 40 years' experience in this business, and head of the firm of L. Connolly and Company of Liverpool, the largest handlers of oranges in England, concerning the possibility of marketing there a portion of this crop. He said that the Californian navel orange was, in his opinion, well adapted for sustaining a long travel and delay in reaching market, far superior in this respect to Florida oranges, which are tender in comparison. He only knew one orange equal to the navel that reached the English market, that is the Jaffa orange, the crop of which is exhausted by February 1, and, therefore, not in competition with the navel, and so far as he was aware there was no additional source of supply of such fruit nearer than California. Heretofore the crop has been a limited one, and readily absorbed by domestic markets; the ideas of growers as to the value of this fruit are rather exalted. Some navels are now procurable as low as 6*s*. per box, but the best are held at from 8*s*. to 10*s*. per box at primary points, and Mr. Connolly could not be sure that a higher price than 14*s*. per box could be realised in Liverpool, at least until the fruit had been introduced and become appreciated; while the cost of transport, which must be usually in refrigerated chambers and by fast freight train to New York, would, of course, be very heavy. A trial car, shipped by the Earl Fruit Company of this city to Mr. Connolly's firm in Liverpool, sold on March 17, 1893, for 14*s*. per box. The expense of shipment is estimated at 10*s*. per box, leaving only 4*s*. per box for the grower. Besides this house, which is very extensive and enterprising, there are various other good firms with which English dealers might correspond, such as the German Fruit Company, the California Fruit Company, Griffin and Skelly of Riverside, and Cook and Langley are very extensively engaged in the domestic trade, but have little faith in the success of dealings with England. They think that country too far away and to possess more convenient sources of supply than California. Besides the navels it is hoped that some sale may also be found in England for our seedlings and Valencia lates, between June and September.

Lemons.—This trade is in process of development here, but as yet even San Francisco imports largely from Sicily.

Deciduous fruits.—Apricots and peaches are produced to a considerable extent, and Southern California appears specially favourable to the apricot. Both are shipped fresh and dried as well as canned, and Mr. Connolly believed the fresh fruit might sell successfully in England, while he was of opinion that our pears and plums could not displace the French and English.

Prunes are a speciality of Northern California, and in a few years that part of the state will yield an enormous surplus of them.

Raisins.—Fresno, in Central California, is the chief seat of this production, though a considerable proportion is also raised in Southern California. The Fresno fruit is a few weeks earlier than ours. Cook and Langley and Griffin and Skelly are the chief packers and shippers. The industry is in rather a bad way, production being even now excessive, and with the prospect of an enormous increase in the immediate future from vines coming into bearing. Unfortunately, this great production has been undertaken on the encouragement of real estate owners, without any definite markets in view beyond the domestic, and it is therefore hard to say what is to become of it all. The raisins are of medium quality, not equal to Malaga fruit, though of the same description, layers and loose muscatels. Much of last season's crop has only netted the growers from ½*d.* to 1*d.* per lb., which, of course, is a dead loss. A portion of the prospective crop may be sold green to the Eastern States, and distillation and syrup manufacture are also suggested as affording some outlet; some may find its way to England and her dependencies, but, beyond doubt, a considerable proportion will never be gathered, and the vines to a large extent will be rooted up by-and-bye to make way for other crops. This refers to proximate production, for all of last year's, reaching 42,000,000 lbs. will find a sale, though at low rates. Sultana or seedless raisins are not in excessive supply, and fetch good prices.

Walnuts. — Southern California is already a large producer of walnuts; about 100 car-loads have been shipped east during the past season. The crop is usually handled by the German Fruit Company of this city, and sells easily, on the average, at about 3½*d.* to 4*d.* per lb. Within five years from now the crop may be so much increased from new plantations as to afford a surplus for export, but at present even the American cities of the Atlantic coast are chiefly supplied from European sources, and the amount of land perfectly suited for this production in Southern California appears to be limited.

Mr. Ernest Watson, an Englishman who has a large orange grove at Duarte, in this county, writes me in reply to some queries I propounded to him to the following effect, that the best districts for orange growing is the eastern portion of Los Angeles county; that the best orange land, with an adequate supply of water, cannot be purchased for less than 100*l.* per acre; that "the Mexican oranges are likely to menace "the Christmas market, but hardly at all after the end of January, as "they come in during September, and our market does not open until, "practically, the middle of February, and continuing until the middle of "June," and that the best oranges to plant are those ripening between April and June (such as "Valencia lates" and "Mediterranean sweets"), when most of the Mexican, Florida, and Mediterranean oranges are out of the market.

CCCXXXIII.—PLANT INDUSTRIES IN THE CAUCASUS.

The following interesting particulars respecting the wine, liquorice and mulberry industries carried on in the Caucasus are taken from the Report of the Statistician of the United States Department of Agriculture for June 1893:—

THE WINE INDUSTRY.

Of highest importance for the present and the future of the country is wine growing. The production does not only suffice for home consumption, but supplies to a large extent the wants of Russia, and besides, furnishes a considerable quantity for export. The efforts of Russia for the advancement of this branch of rural industry are praiseworthy. Under Ottoman rule viticulture could not flourish, as its object was confined to the production of table grapes, and thus it remained on a level with the culture of other fruits. A changed political situation, introduction of new customs, and the effectual assistance of the Russian Government have shown the rural population a rich source of income in wine growing.

Prince Michael Waronzow, the governor of Caucasia, procured in the year 1848, 120,000 vines from his own vineyards in the Crimea and from the most celebrated vineyards of Europe, in order to distribute them among the inhabitants of sections adapted to viticulture.

Not all of them did well; the varieties have been crossed; but a beginning had been made, an impulse given, and this profitable branch of rural industry has developed gradually to its present flourishing condition. There are still a few drawbacks; otherwise the results of this industry would have been enormous. There is, above all, the phylloxera, which has made considerable progress during the last few years. The war upon this plague is waged only on the large estates of rich landholders, while the majority of small vineyards is open to the disease. The damage is largest in the governments of Tiflis and Elizabethpol. In Erivan the winter frosts damage the vines materially.

Area of vineyards.—The vineyards of the Caucasus cover an area of 86,000 desatines (232,174 acres), and their annual production is estimated at 13,000,000 vedros (42,237,000 gallons). The average price of Caucasian wine is generally about 25 cents per gallon and goes up to 30 cents only in years of crop failure.

Profits of viticulture.—Notwithstanding the fact that a desatine of land adapted to viticulture costs 1,000 roubles ($182 per acre), this industry proves to be highly profitable, as the net profit averages from 380 to 400 roubles per desatine ($70 to $75 per acre).

LIQUORICE.

The inhabitants of Elizabethpol and Baku derive considerable benefit from liquorice (*Glycyrrhiza glabra*), which grows wild, needs no cultivation, and multiplies spontaneously. In 1878 two Greeks turned their attention to the large quantities of liquorice in Caucasia; in 1886 they erected a large factory for drying and pressing the liquorice, which they annually export to America. The remunerative trade soon attracted others, and to-day there exist four prominent commercial houses which carry on a wholesale trade in liquorice, and two of which have erected extract factories in this country.

Annually there are produced about 108,339,000 pounds of raw liquorice, which, after drying, yields 36,113,000 pounds of marketable merchandise. For raw liquorice the factories pay on the average 11 cents per 100 pounds.*

Production of Spirits from Mulberries.

The production of spirits from mulberries, pears, cherries, and other fruits depends upon the yearly result of the vintage, as the producers seek to repair the eventual loss in wine and wine-spirits by substituting the above-named fruits. The production during the last five years averaged about 65,000 vedros (211,185,000 gallons) of mulberry spirits free from water. The other fruits are used for this purpose only in inconsiderable quantities.

CCCXXXIV.—MISCELLANEOUS NOTES.

Borneo.—The Right Rev. the Bishop of Singapore and Sarawak (Dr. Hose) has forwarded to Kew a parcel containing 46 dried specimens of ferns, collected by him at Mount Dulet, Sarawak. Six species have proved to be new; descriptions of these by Mr. J. G. Baker, F.R.S., will appear in the Decades Kewenses, given at intervals in the pages of the *Kew Bulletin.*

Asia Minor.—A continuation, numbering about 200 species, of the collection made by Sintenis in Kastamuni (the ancient Paphlagonia) has been purchased for the Herbarium through Dr. K. Keck, of Aistersheim.

India.—From Mr. J. F. Duthie, F.L.S., Director of the Botanical Department, Northern India, comes a collection of upwards of 1,200 specimens of dried plants collected by him in Kashmir.

Mexico.—Herr H. Kiærskou, Inspector of the Botanical Museum, Copenhagen, has presented to Kew 139 specimens of Mexican plants. They are valuable as containing types of the new species of grasses collected by Liebmann, and described by Dr. Eug. Fournier, in his *Mexicanarum Plantarum Enumeratio.*

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* In a Foreign Office Report (No. 1200 of 1893), on the trade of Aleppo, it is stated: "Liquorice root has largely developed, and merits special attention. Collection is now made on a large scale throughout the province, thus compensating in some degree the peasantry for the losses caused by bad harvests. 6,145 tons, valued at 43,231*l.* were exported to the United States, as compared with 4,293 tons, valued at 28,077*l.*, in 1891."

In a further Foreign Office Report (No. 1261 of 1893), on the trade of Damascus, it is stated: "The only business which Damascus may be said to have lost is the liquorice trade, which has practically died out, owing to the discovery of a better quality of root in Northern Syria, in Asia Minor, and elsewhere."

Greenland and Iceland.—To Herr H. Kiærskou Kew is indebted for 129 specimens of dried plants from Greenland and Iceland, gathered by various collectors.

Leitneria floridana, Chapm.—Dr. W. Trelease, Director of the Missouri Botanic Gardens, St. Louis, U.S.A., has forwarded to Kew a specimen of this species, found by him in Missouri. This interesting plant, previously recorded from the salt marshes of Florida only, was placed by its author in the order Myricaceæ, but raised to the rank of a monotypic order by Bentham and Hooker in the *Genera Plantarum* Vol. III., p. 396. A good figure of it is given in Hooker's *Icones Plantarum*, t. 1044. It forms a shrub from 2 to 6 feet high, somewhat resembling a willow, from which it differs in having a solitary ovule affixed laterally. From *Myrica* it is easily distinguished by the absence of resinous glands in the leaves, while the elongated (not globose) inflorescence separates it from *Platanus*.

Wood of Araucaria.—The trunk of the historic *Araucaria imbricata*, referred to in the *Kew Bulletin* for January last, p. 24, as having died during the previous autumn, has been cut up and a specimen deposited in the Museum. The trunk measures about 30 feet high and 1 foot 4 inches in diameter at the base. A sample of the wood of a tree of this species grown at Tortworth Court, Gloucestershire, and a walking stick made of the same wood, both presented by Earl of Ducie, F.R.S., in 1890, are shown in Museum No. 1. The wood is light, soft, and open-grained, and apparently of but little value economically, though in its native country it is said to be strong and durable. The best known timber-producing species of *Araucaria*, however, are the Moreton Bay Pine (*A. Cunninghamii*, Ait.) and the Bunya Bunya (*A. Bidwilli*, Hook.). The first is a native of Northern New South Wales and Queensland, and the second grows only in Queensland. Both are trees of some 100 to 150 feet high, producing planks of very large size and light-coloured even-grained woods suitable for furniture, flooring, and other carpentry work; some samples of the Moreton Bay Pine are prettily marked with small pale clouded knots, somewhat resembling birds-eye maple. It takes a good polish. Good specimens of both these woods are shown in Museum No. 3.

Photographs of Tropical Scenery.—The collection of photographs in the island of Grenada taken by R. V. Sherring, Esq., F.L.S., deposited in Museum No. 3 in June 1892, and noticed in the *Kew Bulletin* for July and August 1892, p. 187, as a loan collection, has recently been acquired for the Museum, and will now form part of the permanent exhibits. This series is of more than ordinary interest and value, both for the excellence of the photographs themselves and for the accuracy of the scenes they represent. A very good idea of the general conformation of the island can be obtained from them as well as of the indigenous and cultivated vegetation. Two of the most striking of the group are, perhaps, those of Lake Antoine looking across the Atlantic and the Grand Etang with virgin forest. Amongst those representing individual plants are the Cacao (*Theobroma Cacao*), a fine group of Nutmeg trees (*Myristica fragrans*), and a tree on the Chantilly stream covered with a luxuriant growth of *Asplenium auriculatum*, and *Acrostichum aureum*.

Oak of Mamre, or Abraham's Oak.—A block of the celebrated oak tree, known as Abraham's Oak, from near Hebron has recently been presented to the Kew Museum by Mrs. E. A. Finn. The history of this interesting specimen is as follows :—Mr. Finn, husband of the lady just referred to, occupied the position of British Consul at Jerusalem and Palestine from 1845 to 1863. The branch, of which the specimen now at Kew is part, was broken off in a snow storm, the piece was purchased by Mr. Finn, who had it cut up and brought to Jerusalem in seven camel loads. The greater part of the branch was made up into small articles and sold for the benefit of poor Jews in Palestine. Dr. (now Sir Joseph) Hooker, in a paper, "On Three Oaks of Palestine," read before the Linnean Society of London on 20th June 1861 (*Transactions Linn. Soc.*, Vol. XXIII., p. 381), refers to this tree as the prickly evergreen oak thus :—" *Quercus pseudo-coccifera* is by far the most abundant " tree throughout Syria, covering the rocky hills of Palestine especially " with a dense brushwood of trees 8–12 feet high, branching from the " base, thickly covered with small evergreen rigid leaves, and bearing " acorns copiously. On Mount Carmel it forms nine-tenths of the " shrubby vegetation, and it is almost equally abundant on the west " flanks of the Antilebanon and many slopes and valleys of Lebanon. " Even in localities where it is not now seen, its roots are found in the " soil and dug up for fuel, as in the valleys to the south of Bethlehem. " Owing to the indiscriminate destruction of the forests in Syria, this " oak rarely attains its full size. We saw but few very good trees; one " of which is the famous oak of Mamre, called 'Abraham's Oak,' and " I saw other good ones at Anturah on the Lebanon. Leaves and " acorns of both these were carefully compared with those of the stunted " form that grew around them and elsewhere, and presented no difference " whatever. The 'Abraham's Oak' is popularly supposed to indicate " the spot where grew the oak or lentisk (for it is disputed which) " under which the patriarch pitched his tent, and is reverenced accord- " ingly by Jews, Mahommedans, and Christians. In general habit it " much resembles the *Q. Ilex* as grown in this country, but does not " branch so much from the base, the bark is similar in colour and " fissuring, the branches in direction, and the foliage in colour . . . . " In the winter of 1856–57 in the streets of Jerusalem (elev. " 2,200 ft.), the snow fell deep and lay for many days. The accumulation " upon Abraham's Oak was so great that one of the finest boughs " gave way under the weight and fell to the ground. Mr. Schembri, " the highly intelligent dragoman of Jerusalem, informed me that he " was employed by Mr. Finn, British Consul, to bring the bough to that " city for him. Owing to a superstition that any person who should cut " or maim the oak would lose his firstborn son, considerable difficulty " was experienced in procuring hands to saw up the timber for trans- " portation. These were at last brought up from Jerusalem, nearly 25 " miles off, and loaded seven camels with the wood of the one limb of " this fine tree."

Fiji Fruit Trade.—In a report just issued by the Colonial Office on the Fiji Island (No. 72, 1893), the following information is given respecting the fruit trade:—The trade of the Colony has advanced rapidly during the year. The green-fruit trade, however, has not increased to any great extent, and the profits made from the production and export of this staple have undoubtedly fallen off. This is owing, locally, to the presence of a disease among bananas which prevents their bearing. (*Kew Bulletin*, 1890, p. 272; 1892, p. 48.) The Government have for some time been endeavouring to arrange for the temporary services of a pathologist to examine the causes of this disease, and, if possible, to provide a remedy. The trade has also been affected by the competition of the Colony of Queensland in the markets of New South Wales and Victoria. The export of green fruit to New Zealand has, however, doubled within the last four years, as has also that to Victoria. There will always be a sale for Fijian green fruit, as the quality of the bananas produced in Fiji is admittedly superior to that of those coming from Queensland, which are often sold under the name of Fijian bananas. A few of the "Gros Michel" bananas suckers have been imported from Trinidad, with the view of seeing whether they resist the disease better than the locally grown "China" bananas.

Selected Papers from the Kew Bulletin.—The six published volumes of the *Kew Bulletin* (1887–92) contain articles which more or less cover the whole field of commercial enterprise as applied to the vegetable kingdom. These articles are necessarily printed in a disconnected form, in accordance with the principle laid down by the Government that information of public interest should be published as speedily as possible.

It will, therefore, be convenient to bring together occasionally the whole of the published papers relating to one particular subject. The trouble of following these through a series of annual volumes would otherwise in great measure defeat the object in view. A volume now in course of preparation, to be followed from time to time by similar collections, deals with the subject of VEGETABLE FIBRES. This is of first-rate importance to manufacturers at home, and also to our planting Colonies. Amongst other subjects, there will appear for the first time a complete account to date of the very interesting Sisal Hemp industry in Yucatan and the Bahamas.

Sisal in Turks Islands.—The cultivation of the Pita (Sisal) plant continues to make progress, and the report of the Assistant Commissioner at Cockburn Harbour on the subject is encouraging. A large extent of fresh ground has been planted out during the year, and several new buildings have been erected in connexion with the industry. Both companies, it is expected, will be in a position to make small shipments of fibre during 1893. A plantation of Sea Island cotton has also been started on one of the adjacent Cays. (*Colonial Office Report*, No. 74, 1893.)

Vine Diseases.—In a letter dated the 24th July last, addressed to Kew by the Secretary of State for Foreign Affairs, there was enclosed a report by Professor Rāthay, of Vienna, on two diseases of vines known respectively as *the Californian Vine disease* and the *Brunnissure*. Mr. Massee has been good enough to furnish the following brief particulars respecting these diseases:—Professor Emerich Ráthay has given a résumé (Die Weinlaube, 1893) of what is known concerning two forms of vine disease, called respectively "Brunissure" and "California vine disease." The former, first observed in the vineyards of Central France in 1882, has spread rapidly, and is now reported from such distant points as Bessarabia and the United States. The disease is caused by a myxomycete—*Plasmodiophora vitis*, Vial. and Sauv.—closely allied to *Plasmodiophora brassicae*, Wor., the cause of the disease in turnips and cabbages known as "fingers and toes" or "anbury." In the vine the disease is mostly confined to the leaves, and does not, as in the Californian disease, extend to the stem and root; neither is there any distortion of tissues such as results from the attacks of *Plasmodiophora* in other plants. The parasite first develops in the palisade cells of the leaf, and from thence extends to the cells of the spongy parenchyma, occurring only very rarely in the epidermal cells. The first external evidence of the parasite is the presence of small, irregular brown patches on the leaf, these soon increase in size, run into each other, and cover more or less the entire surface except the vines. The wilted appearance of the young shoots, and arrest of development and ripening of the fruit, is the indirect result of the alteration of the leaves by the *Plasmodiophora*. This disease has certainly gained a foothold in England, an example having quite recently been sent to Kew from Sussex for determination. No remedy has yet been discovered, and it has been observed on vines that have been sprayed with sulphate of copper solution for fungoid diseases, its position as an internal parasite protecting it from the effects of any external application. The most exhaustive account of this disease is by Viala and Sauvageau (*Journ. Botanique*, vol. vi., p. 355, 1 pl.; Lechevalier, Paris). The California vine disease, first observed in Los Angeles county in 1882, is devastating numerous Californian vineyards, and has formed the subject of two elaborate reports, issued by the United States Department of Agriculture, 1892. This disease is also caused by a myxomycete, *Plasmodiophora californica*, Viala and Sauv., and the effect is as disastrous as that produced by the dreaded Phylloxera; the parasite attacking with equal energy old and young plants, and in all situations, wild vines, as *V. californica*, not being exempt. The parasite develops within the living cells of the host-plant, the tips of the shoots being first attacked, the disease passing along the branches into the main stem, and finally into the root, thus killing the plant within a short time. The leaves, when first attacked, show patches of a yellowish tinge, soon passing into red, and finally to blackish red, hence the term "black measles," applied by Californian planters at this stage. This disease is unknown in Europe.

Anthracnose in Vines.—The vine disease known by the name of Anthracnose, caused by a minute fungus called *Sphaceloma ampelinum*, De Bary, is well known on the Continent and in North America. As a serious disease, its presence has only been noted in England during the past year, and it is probably widely diffused, specimens have been received at Kew for determination from such distant localities as Dorking and Edinburgh. Anthracnose is an insidious disease, which in its milder forms would not be likely to arouse apprehension on the part of the cultivator, yet successive attacks for four or five years often kill the plant. The young shoots, leaves, flowers, and fruit are attacked. The disease on the young shoots appears at first under the form of minute brown spots, these soon increase in size and become sunk or depressed at the centre, the epidermis becomes broken up into minute white downy particles, and as the disease extends the shoots become almost black, the internodes are short, and the development of the leaves arrested, not expanding, of a harsh, brittle texture, and hairy below. The present disease is quite distinct from the one known as "black-rot," although the two have by some authorities been considered to be identical. The following method of treatment has generally proved effectual in eradicating the disease. In the spring, before the buds open, the plants should be thoroughly sponged with a 50 per cent. solution of sulphate of iron in water; the atmosphere at this time should be kept damp. When the young shoots are about six inches long they should be dusted with flowers of sulphur, and if the disease makes headway, the dusting should be repeated, the sulphur being mixed with an equal quantity of powdered lime. Very badly diseased plants should be removed and burnt, as such are not amenable to the above or any other mode of treatment. A detailed account of this disease, also preventive methods and treatment, is given by Viala. [*Les maladies de la Vigne*. Masson: Paris.]

Extract of Chestnut Bark.—In a Foreign Office Report [No. 1270, Annual Series, 1893] the following particulars are given respecting this new tanning material prepared in the neighbourhood of St. Malo, France:—"This export is developing, hitherto chiefly sent to Belgium, " though a Glasgow house has taken some of late. It is used in the " process of tanning leather, being made of the bark of chestnut trees. " The export has reached 150 tons to 200 tons per month, and it is " expected that the new manufactory of this essence now about to be " opened at Dinan will double the export hence. The only manufactory " in this district at present is at Montreuil-sur-Ille in this department." This information supplements that conveyed in a F. O. Report [No. 578, Annual Series, 1889] on the trade of Corsica, where it is stated that " Chestnut extracts (from Ajaccio) for tanning purposes have been in " demand for England, and considerable quantities have been shipped." It is said that these Chestnut extracts are used for tanning purposes to modify the colour produced by Hemlock extract (obtained from the hemlock spruce (*Tsuga canadensis*).

Rose-growing and pressing in Saxony.—The experimental rose plantations started two years ago in the neighbourhood of Leipzig have given such brilliant results that they are, the Belgian Consul states, being extended. The plants have thriven well through the long and severe winter of 1892-93, and their condition in May left nothing to be desired. It has been shown that it was a false idea to suppose that these flowers require Oriental heat to prosper and acquire a delicate perfume; the experiments at Leipzig having proved that a cool temperature, and even a little damp, is the first condition of a good yield, whilst great heat is the enemy of roses. A special factory has been established in the middle of the plantations by the house which made the first experiments, and it is to be put in operation this summer. Provision is made for dealing each day—we quote the Consul—"with 50,000 kilogs. of leaves. " producing, at least, about 40 kilogs. of oil, water, and pomade of

" roses, valued at 40,000 to 50,000 marks. To start with, the factory
" will have three boilers providing 300 square metres of heated surface,
" and the roses will, immediately they are plucked, be transferred to the
" macerating jars, where, thanks to this procedure, they will deposit their
" perfume in all its freshness and delicacy. Only the quantity of leaves
" required at the moment will be collected, a few minutes sufficing to
" transfer the leaves from the plant to the machines." *Commerce* of the 26th July adds :—This expedition is favourably contrasted with the procedure followed in Turkey and in France, where frequently the roses plucked in the morning are only distilled in the evening. As to the oil of roses produced in Saxony during last year, it is claimed that not only did it not fall short on comparison with the Turkish product, but that it was better than its rival in delicacy and strength, and the lasting character of its perfume.

Pepper in Siam.—After rice and teak, pepper is the principal export from Siam. In 1892, 1,175 tons were exported, a slight falling off compared with the previous year. The pepper business is entirely in the hands of two British firms here, and as bargains are enclosed simultaneously at London and Bangkok by telegraph, it is a perfectly safe trade. The price, during the year, continued to fall, ranging from 22 ticals per picul (30*l.* 10*s.* per ton) for white pepper, and 16 ticals to 10 ticals (22*l.* 3*s.* to 13*s.* 7*s.* per ton) for black. As recently as 1888 the price reached the high figure of 88*l.* per ton. It would appear that the big profits in those years were made by the middlemen—Chinamen who buy the standing crops, and take all risks of disease and worm. All the pepper sold in the Bangkok market comes from Chantaboon, a district on the east coast of the Gulf of Siam about 180 miles from Bangkok. The two firms above referred to do business through the shipping agent—a German, who runs a small steamer once a week to Chantaboon. The pepper crop is gathered in March, and is in the Bangkok market about a month later. When the berries are plucked, they are put through a winnowing machine with three compartments. The heaviest berries drop into the first, and after being macerated in water, by which the outer black covering is removed, become white pepper. The lighter and inferior berries of the second compartment form black pepper, and these in the third are waste, from which the best grains are extracted and added to the second kind. Of the export, two-thirds were white and one-third black pepper. All the white is shipped to London, and the black to China. The local consumption is small. The freight charged from Chantaboon to Bangkok is about 13*s.* 9*d.* per ton, and there is an inland duty of 1 tical per picul, equivalent to 1*l.* 7*s.* 6*d.* per ton. The prospects for 1893 are good. The quantity seems excellent, and there are no complaints of scarcity, though growers assert if the price falls any lower it will be impossible to continue cultivation (*Foreign Office Consular Report*, No. 1267, 1893).

ROYAL GARDENS, KEW.

BULLETIN

OF

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CCCXXXV.—FLORA OF ST. VINCENT AND ADJACENT ISLETS.

INTRODUCTION.

St. Vincent is one of the group of islands known in the West Indies as the Colony of the Windward Islands. The other members of this group are St. Lucia, 21 miles to the north, and Grenada, 68 miles to the south-west. Barbados, under a separate Government, is 100 miles due east.

St. Vincent was discovered by Columbus on the 22nd January 1498. It is situated in 13° 10′ north latitude and 60° 57′ west longitude. It is 18 miles in length and 11 in breadth, and contains, according to the *Colonial Office List*, nearly 85,000 acres of land, about half the area of Middlesex, with only 13,000 acres under permanent cultivation. The population in 1891 was 41,054. The majority of the adjoining islets, known as the Grenadines, are dependencies of St. Vincent. The following account of these is taken from the excellent "Historical Geography of the Colonies," by Mr. C. P. Lucas, of the Colonial Office.

"These dependencies contained at the last census a population of 2,691, the largest of them being Bequia, the next largest Union Island and Cannouan. Bequia is less than nine miles to the south of St. Vincent. It is of irregular shape, long and narrow, running from north-east to south-west, and it has an area of about six square miles. Its principal bay is Admiralty Bay on the western side. It is badly watered, and perhaps hardly deserves the old account given of it in the history of the Caribby Islands, that 'it would be fruitful enough if it were cultivated,' for but little sugar or other products are now grown here, and the main attraction of the island is its game. Père Labat states that in his time Bequia contained dangerous snakes, and was for that reason called Little Martinique, though, as he says, it might equally well for the same reason have been christened Little St. Lucia." (pp. 220, 1).

According to Bryan Edwards (*Hist. West Indies*, I., p. 405) the area of the several islands in the Grenadines is as follows:—Bequia, 3,700 acres; Union, 2,150 acres; Cannouan, 1,777 acres; and Mustique, about 1,200 acres.

The following particulars of the physical condition of St. Vincent are taken from a *Sketch of the Colony* prepared by Mr. T. B. C. Musgrave for the Jamaica Exhibition, 1891 :—

"The geological formation of St. Vincent is volcanic, all the rocks of the island indicating that origin. So recently as in 1812 the 'Soufrière,' a mountain at the north end of the island, 4,048 feet high, broke out in eruption and overwhelmed much of the surrounding country with scoria and ashes ; a deep crater was then formed, closely adjoining one of still larger dimensions, the result of an eruption at a period more remote. At the bottom of the older crater, some 1,600 feet down, is a small lake about a mile in diameter. The water appears impregnated with sulphur and occasionally emits offensive though invisible fumes."

"A central backbone of mountainous country, varying in height from 2,000 to 4,000 feet, and densely wooded, traverses St. Vincent from north to south. Rocky and wooded spurs run down to the sea on the west or leeward coast of the island. The east or windward coast, especially towards the north end of the island, in the Carib country, affords much more level land."

"The Carib country is a broad and fertile tract sloping gently backwards from the sea, for a distance of some four miles, to the base of the hills of the central mountain range which then rises abruptly and culminates in the Soufriere. It derives its name from having, upwards of a century ago, been allotted to the aborigines of the island for their occupation."

"The Soufrière forms the northern end of this mountain range. Next to it is the Morne Agarou, having an elevation of over 4,000 feet. Mount St. Andrew, about 2,500 feet, forms the southern extremity, and dominates the Kingstown valley."

"The valleys are fertile and well watered, with fine streams running through them, which turn the different water mills. These streams, in the dry season, comparatively small, swell into raging torrents after heavy rains. The windward slopes of the Soufrière range are drained by a channel called the Dry River, which runs through the Carib country, and which from its peculiarity deserves notice."

"Before the eruption of the Soufrière in 1812, a stream of average size filled this, now dry, watercourse, and emptied itself into the sea. During the eruption, the channel of the stream was completely filled and choked with scoria, rocks, and gravel, underneath which the water now, in ordinary times, disappears some distance before it reaches the coast, and finds its way to the sea. In floods, however, the water comes down with singular force and volume, filling the rocky bed, which is 200 yards across (where the highway passes it) from bank to bank. The water is described as advancing in huge waves, like the "bore" of a tideway. On these occasions it is very destructive, and it has already washed away many acres of cane land on its right bank."

The slopes of the higher mountains are scored with deep ravines, and during the rainy season white clouds hover over them day and night. Here the vegetation partakes largely of an arboreal character, with an abundant undergrowth of ferns, and on the margins and banks of streams, species of *Scitamineæ*, *Aroideæ*, *Cyperaceæ*, and some palms. Of tree ferns there are four species of *Cyathea*, two species of *Hemitelia*, and three species of *Alsophila*. At all elevations on mountain slopes are numerous open glades, showing the sites of former cultivation—the provision grounds of the natives—that have become covered with coarse grasses and dry-loving ferns. The characteristic fern of such localities is *Gleichenia.*

In the lowlands, in valleys, and on easy slopes, the original vegetation has been for the most part cleared for the cultivation of sugar-cane, arrowroot, and other plants. On rocky cliffs are found numerous bushes and trees of stunted growth, some of them overhanging the sea. With these are an *Agave* and *Bromeliaceæ.*

St. Vincent is singularly free from swamps. Hence, there is nowhere any large extent of the tangled vegetation so characteristic of swampy districts in the tropics. The Mangrove trees are only sparingly distributed. The Manchineel tree (*Hippomane Mancinella*) and the sea-side grape (*Coccoloba uvifera*) are found on sea beaches.

"The climate is, of course, tropical. The temperature is singularly equable, and averages between 75 and 85 degrees. It is tempered by the N.E. trade winds during nine months of the year. During the months of August, September, and October, the winds become variable, and not unfrequently veer to the south or south-west. Hurricanes or heavy gales are rare. St. Vincent is one of the most healthy islands of the West Indies. The slope of the land causes a natural drainage, and there are no swamps or marshes."

In 1890 the Assistant-Director of the Royal Gardens visited St. Vincent during a term of inspection throughout the West Indies, made at the instance of the Secretary of State. His report, which embodies many particulars regarding its present economic position, will be found in the *Kew Bulletin* for 1890 (pp. 140–145).

In the last century St. Vincent was remarkable for possessing the first Botanic Garden (founded 1765), certainly in the West Indies, and perhaps in any tropical part of the world. An account of this garden is given in the *Kew Bulletin* for 1892, pp. 92–100. It lingered on with a precarious existence till the end of the first quarter of the present century. In 1890 it was revived as one of the system of botanical stations established in the West Indies.

The scientific knowledge of the flora of St. Vincent was limited to the present time to the species enumerated in Grisebach's "Flora of the British West India Islands" (1864). He relied upon a collection made by the Rev. Landsdown Guilding preserved in the Kew Herbarium. As will be seen the fact that these specimens were in every case actually derived from the island is not free from doubt. Besides these Grisebach also worked up some other plants in the Kew Herbarium collected by Alexander Anderson, the second Superintendent of the old Botanic Garden, of whom some particulars are given in the *Kew Bulletin* for 1892 (pp. 94–5), also by George Caley, one of Anderson's successors (*K. B. l. c.* p. 97).

These data supplied at first a very imperfect idea of the total flora. It was obviously therefore desirable to take advantage of any opportunity for completing the botanical exploration of the island. In 1889 Mr. F. Ducane Godman, F.R.S., to whom the scientific world is indebted for the munificent investigation of the natural history of Central America, determined to send a zoological collector to St. Vincent. Mr. H. H. Smith, a native of the United States, and an expert of known skill and experience, was engaged. He was accompanied by his wife, and Mr. Godman, thinking that they might also do some useful work for botany, persuaded them after a visit to Kew to undertake the task. On arriving at St. Vincent they ultimately engaged as assistant in botanical collecting Mr. G. W. Smith (now Curator of the Botanical Garden, Grenada), a native of the Windward Islands.

The very copious collections made by the party during the years 1889 and 1890, at Mr. Godman's cost, were presented by him to the Royal Gardens. There is every reason to suppose that as far as it is practicable under such circumstances they exhaust the actual flora so far as flowering plants and ferns are concerned. But there will be doubtless, as even in our own country, always some additional harvest of species to be obtained by residents in the island who can give their time to a closer investigation of its area.

Mr. H. Powell, the Curator of the revived Botanic Garden, has done good service by sending additional collections since 1890.

The flora of the Grenadines previously to the present investigation was practically unknown.

The following enumeration is a catalogue prepared by the Kew staff of all specimens in the Kew Herbarium professing to be derived from St. Vincent, whether indigenous or naturalised.

Each island is indicated throughout the list by its initial letter.

B. - - - Bequia.
C. - - - Cannouan.
M. - - - Mustique.
U. - - - Union.
V. - - - St. Vincent.

As the duplicate specimens have with Mr. Godman's sanction been distributed to various herbaria, the numbers attached to the several specimens of each species are cited throughout for convenience of future reference.

The largest proportion of the plants enumerated were collected by the Smiths. For these no collector's name is given. In the case of other collectors it is added. Synonyms are only given where they are the names employed in Grisebach's flora, which for various reasons are not now adopted.

The statistics of the flora and such points of scientific interest as it presents are discussed in a concluding summary.

As regards the arboreal vegetation of St. Vincent and the most prominent and valuable timber trees of the island, the most recent particulars are given in a *Report upon the Forests of St. Vincent* by E. D. M. Hooper, of the Indian Forest Department, published by the Colonial Office in 1886.

A report upon the fruits of the Colony will be found in the *Kew Bulletin* for 1888 (pp. 187–8).

The position of the once flourishing but now somewhat decaying Arrow-root industry is discussed in the *Kew Bulletin* for 1893 (pp. 191–204).

Enumeration of the Flowering Plants and Ferns of St. Vincent and adjacent Islets.

Dilleniaceæ.

Curatella americana, *L.*—V. 1788. Widely spread in tropical South America.

Magnoliaceæ.

Talauma Plumieri, *DC.*—V. 1234. St. Lucia, Martinique, Dominica and Cuba.

Anonaceæ.

Trigynæa antillana, *Rolfe ;* ramis ferrugineo-pubescentibus, foliis breviter petiolatis oblongis acuminatis coriaceis glabris venis supra impressis subtus prominentibus, floribus axillaribus, bracteis ovato-oblongis concavis ferrugineo-pubescentibus, sepalis late triangulo-ovatis cum pedicellis ferrugineo-strigosis, petalis ovato-oblongis concavis crassiusculis subæqualibus, ovariis uniovulatis.

Forest ridges and valleys. V. 1359, 1539.

" *Arbor*, 20 ped. alta." *Folia* 3½–7 poll. longa, 1¾–2¼ poll. lata. *Pedicelli* 2-3 lin. longi. *Sepala* 1 lin. longa. *Petala* 3 lin. longa.

This tropical American genus has not previously been recorded from the West Indies. The *Genera Plantarum* speaks of the ovules as indefinite, but in those we have examined they range from one to few in number.

Rollinia Sieberi, *A.DC.*—V. 621. Trinidad, San Domingo and South Mexico.

Anona muricata, *L.*—V. 403 ; B. 56 ; M. 157. Native of tropical America, and now very widely cultivated, so that it is difficult to determine where it is really indigenous.

Anona palustris, *L.*—V. 1518. Tropical America, chiefly along the coast.

Anona reticulata, *L.*—V. 877. Common in tropical America, both wild and cultivated.

Anona squamosa, *L.*—V. 531 ; B. 151 ; M. 156. Native of tropical America, but now very generally cultivated in warm countries.

Menispermaceæ.

Chondodendron tomentosum, *Ruiz et Pav.,* syn. Cocculus tamoides, *DC.*—V. 528. Widely dispersed in tropical South America.

Cissampelos Pareira, *L.*—V. 355, 1311, 1877. Common in nearly all tropical countries.

Nymphæaceæ.

Nymphæa ampla, *DC.*—V. 1708. This ranges from Texas and North Mexico to Brazil.

PAPAVERACEÆ.

Argemone mexicana, *L.*—V. 182; B. 233. A Mexican plant, now a common weed in many tropical and sub-tropical countries.

Bocconia frutescens, *L.*—V. 1370. Widely spread in tropical America.

CRUCIFERÆ.

Nasturtium officinale, *R.Br.*—V. 1590. Most probably introduced from Europe, though Grisebach seems to have considered it indigenous in Cuba.

Brassica juncea, *Coss.*, syn. Sinapis Brassicata, *L.*—V. 137. Introduced from the Old World.

Lepidium virginicum, *L.*—V. 670. A North American species, probably introduced in the West Indies.

Cakile æqualis, *L'Herit.*—V., Guilding. Common on sandy sea shores in the West Indies; also found in South Florida and Venezuela.

CAPPARIDEÆ.

Cleome pungens, *Willd.*—V. 4; B. 176. Widely dispersed in tropical America.

Polanisia viscosa, *DC.*, syn. Cleome viscosa, *L.*—V. 21; B. 177. Introduced from tropical Asia.

Gynandropsis pentaphylla, *DC.*, syn. Cleome pentaphylla, *L.*—V. 503; B. 175. Widely diffused through the tropics, but probably introduced in the New World.

Capparis amygdalina, *Lam.*—V. 1820; M. 118. Widely spread in tropical America.

Capparis cynophallophora, *L.*, syn. Capparis eustachiana, *Jacq.*—V. 1039, 1622; B. 131; C. 4; M. 116. Widely diffused along the sea-shores of tropical America, also in Fernando Noronha.

Capparis jamaicensis, *Jacq.*—V., Guilding; C. 7; M. 117; U. 17, also Powell 91. South Florida and West Indies.

Cratæva gynandra, *L.*—V., Guilding; B. 146. Widely spread in tropical America.

VIOLARIEÆ.

Corynostylis Hybanthus, *Mart.*—V., Guilding. South Mexico to Columbia and North Brazil.

Sauvagesia elata, *Benth.*—V., Guilding. British Guiana.

Sauvagesia erecta, *L.*—V. 53. Widely dispersed in tropical and sub-tropical America, also in West Africa, Madagascar, Java, &c.

BIXINEÆ.

Bixa Orellana, *L.*—V. 167. Widely dispersed in tropical and sub-tropical America, and cultivated and naturalised in other countries.

Flacourtia Cataphracta, *Roxb.*—V. 559; M. 121, 148. Naturalised.

POLYGALEÆ.

Polygala paniculata, *L.*—V. 570, 1190. Widely dispersed and common in tropical America, from South Mexico to Uruguay.

Securidaca Lamarckii, *Griseb.*—V. 719; B. 276. Martinique, Cuba and Jamaica.

CARYOPHYLLEÆ.

Drymaria cordata, *Willd.*—V. 162, 1367. In almost all tropical and sub-tropical regions.

PORTULACEÆ.

Portulaca oleracea, *L.*—V. 1939; M. 25. Tropical and sub-tropical regions generally.

Portulaca pilosa, *L.*—V. 1196; B. 247. Throughout tropical and sub-tropical America.

Talinum patens, *Willd.*—V. 202, 1583; B. without number. Widely spread in tropical and sub-tropical America.

HYPERICINEÆ.

Vismia ferruginea, *H. B.K.*—V., Guilding. Trinidad, Guiana and Brazil.

GUTTIFERÆ.

Clusia alba, *L.* (*Griseb.*)—V. 339, 349. St. Lucia, Martinique, Dominica, Guadeloupe and Cuba.

Clusia, *sp.*—V. 1318; B. 121. And a second undetermined species from Bequia, without a number.

Rheedia lateriflora, *L.*—V. 482. Martinique, Dominica, Guadeloupe, Jamaica and Trinidad.

Calophyllum Calaba, *Jacq.*—V. 73; B. 39. Widely dispersed in tropical South America.

Mammea americana, *L.*—V. 727. Widely dispersed in tropical South America.

TERNSTŒMIACEÆ.

Marcgraavia umbellata, *L.*—V. 997. Widely spread in tropical South America.

Norantea Jussiæi, *Tr. & Pl.*, syn. Marcgraavia spiciflora, *Rich.*—V. 1281. Dominica and Guadeloupe.

Freziera hirsuta, *Sm.*—V., Guilding. Jamaica and Cuba.

Freziera undulata, *Sw.*—V. 575. St. Lucia, Martinique, Dominica, Montserrat, St. Kitts, Jamaica and Trinidad.

Marila racemosa, *Sw.*—V. 36. St. Lucia, Martinique, Dominica, Montserrat, St. Kitts, Cuba and Trinidad.

MALVACEÆ.

Malvastrum spicatum, *A. Gr.*—V. 1597; B. 214. Common in tropical and sub-tropical America, also in Australia, Timor and the

Cape Verde Islands. It is uncertain whether it is really indigenous in the Old World, though Robert Brown collected it in Queensland early in the present century, and it is now very common in East Australia.

Malvastrum tricuspidatum, *A. Gr.*—V. 818; B. 164; U. 29, also Powell 92. Common in tropical and sub-tropical America, and naturalised in India, the Canary Islands, &c.

Sida carpinifolia, *L.*— V. 113, 113*a*, 991; B. 162, 163; M. 75; U. 33, 34. Widely dispersed in tropical and sub-tropical regions.

Sida ciliaris, *L.*—B. 171. Florida and Mexico to Brazil.

Sida cordifolia, *L.*—V. 200; B. 159. Common in tropical America, also in Africa and Mauritius.

Sida glomerata, *Cav.*—V. 1058; C. 13. Widely dispersed in tropical America.

Sida rhombifolia, *L.*—V. 786. Common and widely dispersed in tropical and sub-tropical regions.

Sida spinosa, *L.*—V. 1059, 1649. Generally dispersed in the tropics.

Sida urens, *L.*—V. 1341. Common in tropical America, also in Africa and Madagascar.

Wissadula rostrata, *Planch.*, syn. Abutilon periplocifolium, *G. Don.*—C. 16. Widely dispersed in tropical America, also common in tropical Africa and Java.

Abutilon crispum, *G. Don.*—V. 695; B. 8; M. 72. Common in south-eastern North America and Central America, also in the western peninsula of India.

Abutilon indicum, *G. Don.*—V., Guilding; and **var. hirtum**, *Griseb.*—B. 156. Widely diffused in the tropics.

Abutilon umbellatum, *Sweet.*—B. 157, 166; M. 71; U. Powell 88. Jamaica and St. Thomas.

Malachra capitata, *L.*—V. 579; M 73. Widely dispersed in the tropics.

Malachra radiata, *L.*—V., Guilding. Widely dispersed in tropical America, and also found in West Africa.

Urena lobata, *L.*—V., Guilding. Common and widely dispersed through the tropics.

Urena sinuata, *L.*—V. 99. Widely dispersed in tropical regions.

Pavonia microphylla, *Casar.*—V., Guilding. Brazil.

Pavonia typhalæa, *Cav.*—V. 606, 1359. Widely spread in tropical America.

Hibiscus Abelmoschus, *L.*, syn. Abelmoschus moschatus, *Medic.*—V. 773. Naturalised. A native of tropical Asia and perhaps also of tropical Africa, where, however, as well as in many other countries, it is extensively cultivated.

Hibiscus phœniceus, *Jacq.*—V., Guilding. Common in tropical South America.

Hibiscus radiatus, *Cav.*—V. 1650. Introduced from tropical Asia.

Hibiscus rosa-sinensis, *L.*—V. 1342. Naturalised. It is uncertain where this is really native, as it has long been cultivated in warm countries, and is now also common in a wild state.

Hibiscus Sabdariffa, *L.*—V. 1601. Introduced. Extensively cultivated in the tropics. Uncertain where indigenous.

Hibiscus tiliaceus, *L.*, syn. Paritium tiliaceum, *A. Juss.*—V. 283, 488, 493 ; B. 161. A common tree on the sea coast in nearly all tropical countries, including many remote islands.

Hibiscus vitifolius, *L.*—V. 1648. Naturalised from the Old World, where it is common in tropical Asia and Africa, and it is also found in Australia.

Thespesia populnea, *Corr.*—V. 547 ; B. 160. Widely dispersed through the tropics of the Old World, now common in the West Indies, chiefly near the coast.

Gossypium barbadense, *L.*—V. 1653. Introduced.

Eriodendron anfractuosum, *DC.*—V. 159. Inhabits tropical America, Africa and Asia, supposing the species to be the same throughout, concerning which there is much difference of opinion.

Ochroma Lagopus, *Sw.*—V. 253. Widely dispersed in tropical America.

STERCULIACEÆ.

Sterculia caribæa, *R. Br. et Benn.*—V. 459, 645. St. Lucia, Martinique, Dominica, Jamaica and Trinidad.

Myrodia turbinata, *Sw.*—V. 496. Mexico, through the West Indies to Guiana and Brazil.

Melochia nodiflora, *Sw.*—V. 1055; M. 70. West Indies, South Mexico, and Central America to Columbia and Venezuela.

Melochia tomentosa, *L.*—V. 1061 ; B. 167 ; C. 19 ; M. 85, 86 ; U. 30. Common and widely diffused in tropical America.

Waltheria americana, *L.*—V. 600; B. 158. Widely dispersed through tropical and sub-tropical regions.

Guazuma ulmifolia, *Lam.*—V. 197, 517 ; B. 36, 37. Widely dispersed in tropical America.

Buettneria scabra, *L.*—V., Guilding. Common in eastern tropical America, extending to Trinidad and St. Vincent.

TILIACEÆ.

Triumfetta grandiflora, *Vahl.*—V. 1060, 1942. Martinique, Dominica, Mexico and Peru.

Triumfetta grossularifolia, *Rich.*—V. 1057, 1943. Cuba.

Triumfetta Lappula, *L.*—V., Guilding. A common tropical American species.

Triumfetta rhomboidea, *Jacq.*—V. 473. Widely dispersed through the tropics.

Triumfetta semitriloba, *L.*—V. 105, 599, 841, 1343, 1945 ; B. 154, 155. Common in nearly all tropical countries.

Corchorus acutangulus, *L.*—V. 1340 ; B. 168 ; M. 8. Widely diffused in the tropics.

Corchorus hirtus, *L.*—V. 709; B. 165, 170. Eastern tropical America, also Antigua and Tobago.

Corchorus siliquosus, *L.*—V. 1056, 1944; B. 169; M. 9. Widely dispersed in tropical America, from Florida and Mexico to Peru and Brazil.

Apeiba Tibourbou, *Aubl.*—V., Guilding. Widely dispersed in tropical America.

Prockia crucis, *L.*—V. 1847. Widely diffused in tropical America, and northward into Mexico.

Sloanea sinemariensis, *Aubl.* (*non Griseb.**).—V. 535. Martinique, Dominica and Guiana.

LINEÆ.

Erythroxylon obovatum, *Macf.*—V., Guilding. Martinique, Jamaica, Cuba, Bahamas and Bonacca Island on the coast of Honduras.

Erythroxylon obtusum, *DC.*—V. 852, 1525; B. 50, 85; M. 120. St. Lucia, Martinique, Porto Rico, San Domingo, Cuba, Grenada, Tobago and Trinidad.

HUMIRIACEÆ.

Saccoglottis amazonica, *Mart.*—V., Guilding. Brazil. Mr. H. A. A. Nicholls picked up drift fruits of this on the windward side of Mustique Island in 1891.

MALPIGHIACEÆ.

Byrsonima coriacea, *DC.*—V. 491, 609, 1253, 1824. Dominica, San Domingo and Jamaica.

Byrsonima spicata, *Rich.*—V. 449, 634. East tropical America and West Indies.

Malpighia coccigera, *L.*—V. 1725. St. Lucia, Martinique, Dominica and Cuba.

Malpighia punicifolia, *L.*—V., Guilding; B. 77. West Indies and tropical America.

Malpighia urens, *L.*—V. 344; B. 144. Guadeloupe, Cuba and Jamaica.

Bunchosia glandulosa, *Rich.*—V. 77, 524, 1316, 1777; B. 145; M. 119. Widely diffused in tropical America.

Bunchosia, *sp.*—V. 1775.

Spachea perforata, *Juss.*—V., Guilding. Not known from elsewhere.

Heteropterys platyptera, *DC.*—V. 1549. Widely dispersed in tropical America.

Heteropterys purpurea, *H. B. et K.*—V. 1278, 1299, 1867; B. 83, 283; M. 37. Widely dispersed in the West Indies, and, according to Grisebach, also found in Venezuela.

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* S. sinemariensis, Grisebach, is a quite different species, of which the following is the amended synonymy:—Sloanea Purdiei, Griseb., ex Benth. et Hook. f. Gen. Pl. II. p. 653 (in nota); S. sinemariensis, Griseb. Fl. Brit. W. Ind., p. 99 (non Aubl.); Pouteria guianensis, Griseb. Fl. Brit. W. Ind., p. 402 (non Aubl.). In both cases the locality "Guiana" must be excluded. The St. Kitts specimen cited we have not seen, though it is probably S. sinemariensis, Aubl. S. Purdiei was collected in Trinidad by Purdie, Crüger, and Prestoe.

Stigmaphyllon fulgens, *Juss.*—V., Guilding. Guiana and Brazil.

Stigmaphyllon puberum, *Juss.*—V. 220, 1261. West Indies, Guiana, and Brazil.

Stigmaphyllon, *sp.*—V. 418.

Tetrapterys inæqualis, *Cav.*—V. 1548, 1863. West Indies, also, according to Grisebach, Costa Rica and Brazil.

Hiræa simsiana, *Juss.* syn. Mascagnia simsiana, *Griseb.*—V. 429. Jamaica, Tobago and, on the authority of Grisebach, Guiana.

ZYGOPHYLLEÆ.

Tribulus maximus, *L.*—V. 1580; B. 240, 271; M. 29. Common and widely dispersed in tropical and sub-tropical America; also found in West Africa.

Guaiacum officinale, *L.*—V. 309. West Indies and Venezuela.

GERANIACEÆ.

Oxalis corniculata, *L.*—V. 216, 974, 975. Almost cosmopolitan in warm and temperate regions.

Oxalis corymbosa, *DC.*, syn. O. Martiana, *Zucc.*—V. 885. Brazil. Probably introduced in St. Vincent.

Oxalis frutescens, *L.*—V. 793. West Indies and Eastern tropical America.

Oxalis sepium, *St. Hil.*—V. 153. Widely dispersed in tropical America.

Averrhoa Bilimbi. *L.*—V., Guilding. Introduced? Cultivated and wild in the tropics of both hemispheres, but it is uncertain where it is indigenous, though probably in America.

Impatiens Balsamina, *L.*—V. 177, 205. Introduced and colonised.

RUTACEÆ.

Zaxthoxylum microcarpum, *Griseb.*—V. 614. Previously known only from Dominica and Trinidad.

Zanthoxylum spinosum, *Sw.*, syn. Tobinia spinosa, *Desv.*—V. 1742, 1743. Dominica, Jamaica and Cuba.

Triphasia trifoliata, *DC.*—V. 420; M. 143. Introduced. Common in both eastern and western tropical countries, but quite uncertain where it is really indigenous, though probably in the Old World.

Murraya exotica, *L.*—B. 80. Introduced. Commonly cultivated in the tropics, and wild in tropical Asia, Australia and Polynesia.

Citrus Aurantium, *L.*—V. 815; and **var. spinosissima,** *Mey.*, syn., C. Lima, *Macf.*—V. 79. Introduced from Asia.

Citrus medica, *L.*, **var. Limonum,** *Risso.*—V. 888. Introduced from Asia.

SIMARUBEÆ.

Quassia amara, *L. fil.*—V., Guilding. Martinique, Trinidad and tropical America. Said to be introduced in Jamaica.

Simaba orinocensis, *H. B.K.*—V., Guilding. Guiana and equatorial Brazil.

Simaruba amara, *Aubl.*—V. 1544. St. Lucia, Martinique, Dominica, Bahamas and Guiana.

Picræna excelsa, *Lindl.*—V. 498, 647. Antigua and Jamaica.

Suriana maritima, *L.*—B. 5, 104; M. 153; U. 17. Common on the coast almost throughout the tropics, including many remote islands.

OCHNACEÆ.

Gomphia nitida, *Sw.*—V., Guilding. St. Lucia, Antigua, St. Thomas, Cuba, Jamaica, Ruatan Island, in the Bay of Honduras, and Trinidad.

BURSERACEÆ.

Protium guianense, *March*, syn. Icica heptaphylla, *Griseb. Fl. Brit. W. Ind.*, p. 173. (*non Aubl.*).—V., Guilding. West Indies, Guiana and Venezuela.

Bursera gummifera, *L.*—V. 169, 415, 1551; B. 143, 147, 330; M. 142, 159. West Indies and Tropical America.

Dacryodes hexandra, *Griseb.*—V. 752. Porto Rico, Montserrat, Dominica, Martinique and St. Lucia, and Grisebach records it from Nevis. (At first mistaken for a *Trattinickia.*)

Amyris maritima, *Jacq.*—B. 149, 150. Porto Rico, Cuba, Trinidad and Venezuela.

Amyris sylvatica, *Jacq.*—V. 1844. South Florida, West Indies and New Granada.

MELIACEÆ.

Melia Azedarach, *L.*, syn. M. sempervirens, *Sw.*—V. 76. Introduced from Asia.

Guarea perrottetiana, *A. Juss.*—V. 172. Martinique, Dominica and Guadeloupe.

Guarea Swartzii, *DC.*—V. 398, 532. Dominica, Guadeloupe, Jamaica and Trinidad.

Trichilia, *sp.*—V. 661.

Carapa guianensis, *Aubl.*—V. without number. Dominica, Trinidad, Nicaragua, Guiana, Brazil and West tropical Africa.

Swietenia Mahogani, *L.*—V. 1627. South Florida, West Indies and Central America.

OLACINEÆ.

Ximenia americana, *L.*—V., Guilding. Widely diffused through the tropics, including Polynesia, if *X. elliptica*, Forst., be regarded as a form of it.

Schœpfia arborescens, *Rœm. et Sch.*—B. 148; U. 14. South Florida, West Indies and Central America.

ILICINEÆ.

Ilex dioica, *Griseb.*—V. 1563. Cuba and Jamaica.

Ilex, *sp.* = 279, Hahn, from Martinique.

CYRILLEÆ.

Cyrilla antillana, *Michx.*—V. 948. West Indies and East tropical America.

CELASTRINEÆ.

Maytenus, tetragonus, *Griseb.*, syn. M. gonocladus, *Griseb.* (*non Mart.*). V. 1285, 1564, 1565. Grenada, Trinidad and, according to Grisebach, Guiana.

Maytenus, *sp.*—V. 662, and a second species, B. 62. Possibly both undescribed, but the whole genus is in need of revision.

Myginda latifolia, *Sw.*—V. without number. Common in the West Indies.

Myginda pallens, *Sm.*—V., Guilding. South Florida and West Indies. This and the preceding may be states of the same species.

Elæodendron dioicum, *Griseb.*—V. 446, 1807; B. 125, 126. Guadeloupe, Cuba and Jamaica.

Hippocratea malpighifolia, *Rudge.*—V., Guilding. West Indies and East tropical America.

RHAMNACEÆ.

Condalia ferrea, *Griseb.*—V. 1845. South Florida, Bahamas, St. Thomas, Porto Rico, Dominica and Jamaica.

Colubrina reclinata, *Brongn.*—V. 1731. South Florida and West Indies.

Gouania domingensis, *L.*—V. 1302; B. 38. West Indies and East tropical America.

AMPELIDEÆ.

Vitis sicyoides, *Baker*, syn. Cissus sicyoides, *L.*—V. 508, 1304, 1881. Also a monstrous variety.—V. 384, 1928; B. 313; M. 45. Widely spread in the West Indies and tropical America.

Vitis trifoliata, *Baker*, syn. Cissus trifoliata, *L.*—V. 1882. Widely diffused in the West Indies and tropical America.

SAPINDACEÆ.

Urvillea seriana, *Griseb.*—V. 1297, 1619; M. 93. West Indies and tropical America.

Cardiospermum Halicacabum, *L.*—V., Guilding. Throughout the tropics.

Cardiospermum microcarpum, *H. B.K.*—V. 521, 1296; B. 313. Widely diffused in tropical regions.

Paullinia Vespertilio, *Sw.*—V., Anderson. Dominica, and Grisebach records it from St. Lucia and St. Kitts.

Schmidelia occidentalis, *Sw.*—V. 674. West Indies and East tropical America.

Sapindus inæqualis, *DC.*—V., Guilding. Widely dispersed in tropical America.

Hypelate paniculata, *Camb.*—V. 1545. South Florida, Mexico and West Indies.

Dodonæa viscosa, *L.*—M. 129. Cosmopolitan in warm countries.

Turpinia occidentalis, *Don.*—V. 258. West Indies and Central America.

SABIACEÆ.

Meliosma Herbertii, *Rolfe* ; arbor (fide *Smith*) ramulis floriferis pubescentibus demum glabris, foliis petiolatis lanceolato- v. obovato-oblongis breviter acuminatis basi attenuatis lævibus, paniculis terminalibus ferrugineo-pubescentibus densifloris, bracteis ovato-oblongis, floribus subsessilibus, sepalis orbicularibus concavis minute ciliatis, petalis similibus sed eciliatis, ovario glabro, fructu pyriformi.

V. 830, 1837. "A small forest tree, 30 to 60 feet high, occurring "from 500 to 2,000 feet elevation. Not common. Flowers in April "and May."

Folia 4–6 poll. longa, 1½–2½ poll. lata ; *petiolus* 6–8 lin. longus. *Paniculæ* 4–6 poll. longæ. *Flores* vix lineam longi. *Fructus* 8 lin. longus.

This is the second West Indian species in the genus, one being previously known from Cuba.

ANACARDIACEÆ.

Comocladia ilicifolia, *Sw.*—V. 1528 ; B. 71 ; M. 126. St. Lucia, Antigua, St. Kitts, St. Thomas and Porto Rico.

Mangifera indica, *L.*—V. 1268. Naturalised. A native of tropical Asia, and cultivated in most tropical countries.

Anacardium occidentale, *L.*—V. 683. West Indies and tropical America ; naturalised in India and other parts of the Old World.

Spondias lutea, *L.*—V. 58 ; B. 124 ; M. 160. West Indies and tropical America.

Spondias purpurea, *L.*—V. 1527. West Indies and tropical America.

MORINGEÆ.

Moringa pterygosperma, *Gærtn.*— V. 1001 ; B. 332. Introduced from the Old World. A native of the forests of the Western Himalaya, and cultivated in other parts of India.

CONNARACEÆ.

Connarus guianensis, *Lamb.*—V., Guilding. Trinidad and Guiana.

LEGUMINOSÆ.

Crotalaria anagyroides, *H. B.K.*—V. 1034. Widely dispersed in tropical America.

Crotalaria fulva, *Roxb.*—V., Guilding. Introduced from the East Indies.

Crotalaria incana, *L.*—V. 1902 ; B. 256 ; M. 101. Widely diffused in tropical America, also found in tropical Asia, Africa and Australia.

Crotalaria pumila, *Ort.*—V., Guilding. Mexico, West Indies and tropical America.

Crotalaria retusa, *L.*—V. 176 ; B., M. and U. Cosmopolitan in the coast regions of warm countries.

Crotalaria stipularis, *Desv.*—V. 157, 1053. West Indies and East tropical America.

Crotalaria verrucosa, *L.*—V. 248 ; B. 263 ; M. 103 ; U. 8. Widely dispersed in the warm countries of both hemispheres, but perhaps only colonised in America.

Indigofera Anil, *L.*—V. 39, 1189 ; B. 264 ; M. 100. Common in the warmer parts of America, and widely naturalised in the Old World.

Indigofera hirsuta, *L.*—V., Guilding. Introduced from the Old World, where it is common in tropical Asia and Africa ; it also occurs in Australia.

Indigofera tinctoria, *L.*—V. 1007, 1048. Introduced from the Old World, where it is extensively cultivated and widely spread in a wild state in warm regions.

Tephrosia cinerea, *Pers.*—V. 556. Widely dispersed in tropical America.

Cracca caribæa, *Benth.*—V. 1041 ; B. 265. West Indies and Central America.

Sesbania grandiflora, *Pers.*, syn. Agati grandiflora, *Desv.*—V. 352. Introduced from the Old World, where also it is often cultivated. It is a native of the Malay archipelago and North Australia.

Chætocalyx vincentinus, *DC.*—V. 1176, 1905 ; B. 262 ; C. 27 ; M. 91, 94 ; U. 10. Dominica.

Æschynomene americana, *L.* — V. 642. Common in tropical America.

Æschynomene sensitiva, *Sw.*—V. 217. Very common in tropical America, and found also in West tropical Africa, though probably introduced.

Stylosanthes procumbens, *Sw.*—B. 242. Common in the West Indies and tropical America.

Arachis hypogæa, *L.*—V. 1054. Introduced ; widely cultivated in the tropics. Probably a native of South America, where all the other species of the genus are indigenous.

Desmodium adscendens, *DC.*—V. 97. Widely dispersed in tropical America, and also occurring in West tropical Africa.

Desmodium axillare, *DC.*—V., 764, 768. Mexico and the West Indies to Peru and South Brazil.

Desmodium incanum, *DC.*—V. 118, 998 ; B. 250. Very common in tropical America and the West Indies, and also found in West Africa and Mauritius.

Desmodium latifolium, *DC.*—V., Guilding. Introduced from the Old World, where it is very common in tropical Asia.

Desmodium polycarpum, *DC.*—V., Guilding. Introduced from the Old World, where it is exceedingly common in the warmer parts of Asia and Polynesia, and has also been found in East Australia.

Desmodium scorpiurus, *Desv.*—V. 101. Widely diffused in tropical America, and also found in the Society Islands.

Desmodium spirale, *DC.*—V. 1036 ; U. 6. Widely spread in the warmer parts of America, also found in tropical Asia, Africa, and Polynesia.

Desmodium tortuosum, *DC.*—V. 765 ; B. 277 ; M. 99. Widely diffused in the warmer parts of America.

Desmodium triflorum, *DC.*—V. 148. Almost cosmopolitan in tropical countries.

Lourea vespertilionis, *Desv.*—V., Guilding. Introduced from the East Indies.

Alysicarpus vaginalis, *DC.*—V. 92, 92*a* ; B. 249. Introduced from the East Indies.

Abrus precatorius, *L.*—V. 763. Widely dispersed in the warmer countries of the globe.

Centrosema Plumieri, *Benth.*—V., Anderson. Common from Mexico and the West Indies to South Brazil.

Centrosema pubescens, *Benth.*—V. 1183. Widely spread in tropical America, with the same range as the last.

Centrosema virginianum, *Benth.*—V. 513, 1175 ; B. 252 ; C. 28 ; M. 90. Maryland, North America, through Mexico and the West Indies into South America, also found in tropical Africa.

Clitoria Ternatea, *L.*—V. 823 ; B. 253 ; U. 4. Widely dispersed through the tropics.

Clitoria glycinoides, *DC.*—V. 402. West Indies and tropical South America.

Teramnus labialis, *Spreng.*—V. 1042 ; B. 259. Widely dispersed in the warmer countries of the globe.

Erythrina Corallodendron, *L.*—V. 64. Widely dispersed in tropical America.

Erythrina glauca, *Willd.*—V. 1630. West Indies and tropical America.

Erythrina indica, *Lam.*—V., Guilding. Introduced from the East Indies.

Mucuna altissima, *DC.*—V. 538. West Indies and tropical South America.

Mucuna pruriens, *DC.*—V. 935. Common throughout the tropics.

Calopogonium cæruleum, *Hemsl.* syn. Stenolobium cæruleum, *Benth.* —V. 1637. Widely dispersed in tropical America from Mexico and Cuba to Peru and South Brazil.

Calopogonium mucunoides, *Desv.*—V. 884. Central America, Guiana and Brazil.

Galactia longiflora, *Arn.*—V. 1004, 1182, 1914 ; C. 29. Common in the West Indies.

Dioclea reflexa, *Hook. f.*—V. 1030, 1030*a*, 1635. Widely dispersed in the tropics.

Canavalia ensiformis, *DC.*, syn. C. gladiata var. ensiformis, *DC.*—V. 1178, 1179, 1638. Widely distributed in warm regions of the globe.

Canavalia obtusifolia, *DC.*—V. 548, 597 ; B. 254. Widely dispersed in tropical regions, including remote islands, where it often springs up from seeds cast ashore.

Phaseolus adenanthus, *Mey.*—V. 123, 1180. Tropical America, Australia and India.

Phaseolus lunatus, *L.*—V. 1185, 1636. Cultivated and wild in the tropics generally.

Phaseolus semierectus, *L.*—V. 1002, 1003, 1640; B. 257, 258; M. 102. Common in tropical America and India, though probably a colonist in the latter country.

Phaseolus vulgaris, *L.*—V. 168. Universally cultivated, and commonly wild in most hot countries, but it is uncertain where it is indigenous.

Vigna luteola, *Benth.*—V. 270, 595, 769; B. 16. Widely dispersed in the warmer parts of America, and cosmopolitan in the tropics.

Vigna sinensis, *Endl.*—V. 1035, 1181. Widely cultivated in the tropics and sub-tropics, including China, but native country uncertain.

Vigna vexillata, *Benth.*—V. 145. Widely dispersed in the warmer countries of the globe.

Pachyrhizus angulatus, *Rich.*—V. 598, 598*a*, 1916; B. 255. Widely dispersed in the tropics, and generally cultivated.

Dolichos Lablab, *L.*—V. 586; B. 251. Widely dispersed in the tropics.

Cajanus indicus, *Spreng.*—V. 499. Common in nearly all tropical countries.

Rhynchosia minima, *DC.*—V. 518, 1294; B. 260; M. 92; U. 5. Widely dispersed in the tropics.

Rhynchosia phaseoloides, *DC.*—V. 1174. Widely dispersed in tropical America.

Rhynchosia reticulata, *DC.*—V., Guilding. Widely spread in tropical America.

Flemingia strobilifera, *R. Br.*—V. 436. Introduced from the East Indies.

Ecastaphyllum Brownii, *Pers.*—V. 46; B. 284. West Indies, tropical America, and West tropical Africa.

Ecastaphyllum Monetaria, *Pers.*—V. 395, 1366. West Indies and East tropical America.

Machærium robinifolium, *Vog.*—V. 903. West Indies and East tropical America.

Drepanocarpus lunatus, *Mey.*—V., Guilding. West Indies, tropical America and West tropical Africa.

Pterocarpus Draco, *L.*—V. 1631. West Indies and tropical America.

Pterocarpus Rohrii, *Vahl.*—V., Guilding. Trinidad and East tropical America.

Platymiscium polystachyum, *Benth.*, syn. P. platystachyum, *Griseb. Fl. Brit. W. Ind.*, p. 200, errore.—V., Guilding. Trinidad and tropical America.

Lonchocarpus latifolius, *H. B.K.*—V. 1629, 1907, 1908. Common in tropical America.

Lonchocarpus violaceus, *H. B.K.* — V. 588, 742, 1906; B. 268; M. 111. West Indies and tropical America.

Piscidia Erythrina, *L.*—V. 1632. South Florida and West Indies, and Grisebach records it from Guayaquil.

Andira inermis, *H. B.K.*—V. 74. West Indies, tropical America, and West tropical Africa.

Inocarpus edulis, *Forst.*, syn. Etaballia macrophylla, *Benth.*—V., Guilding. Introduced from Polynesia.

Sophora tomentosa, *L.*—V. 225; U. 12. All tropical sea shores, and extending to sub-tropical latitudes, including many remote islands.

Ormosia dasycarpa, *Jacks.*—V. 460, 1909. Guadeloupe, Dominica, and St. Lucia, and Grisebach records it from Montserrat.

Dussia martinicensis, *Kr. et Urb. ex. Taub. in Engl. et Prantl Nat. Pflanzenf.*, III., pt. 3, p. 193.—V. 1633. A monotypic genus previously only known from Martinique.

Diplotropis brachypetala, *Tul.*—V. 1910. Trinidad and Guiana.

Swartzia grandiflora, *Willd.*—V. 483; B. 119. West Indies and tropical America.

Cæsalpinia Bonducella, *Fleming*, syn. Guilandina Bonducella, *L.*—V. 766; M. 97. Widely dispersed through the tropics.

Cæsalpinia Crista, *L.*—V., Guilding. Bahamas and Cuba.

Cæsalpinia pulcherrima, *Sw.*—V. 767, 1038 Widely dispersed in the tropics. Commonly cultivated.

Cæsalpinia sepiaria, *Roxb.*—V. 1046. Introduced from the East Indies.

Hæmatoxylon campechianum, *L.*—V. 814, 1911; B. 272; M. 105. West Indies, Central and tropical America.

Parkinsonia aculeata, *L.*—V., Guilding; B. 13; C. 1; U. Powell 97. Widely dispersed in tropical America, and naturalised in tropical Asia and Africa.

Cassia alata, *L.*—V. 363. Tropical America, West Africa, India and Polynesia.

Cassia bacillaris, *L.*—V. 1051. Widely dispersed in tropical America, from Mexico and West Indies southward.

Cassia bicapsularis, *L.*—V. 761; M. 115. North Mexico and the West Indies to South Brazil and Chili.

Cassia diphylla, *L.*—V., Anderson. Widely dispersed in tropical America, from Mexico southward.

Cassia emarginata, *L.*—V., Guilding. West Indies and northern part of South America.

Cassia Fistula, *L.*—V. 941, 1032; B. 278. Introduced from the Old World, but now commonly cultivated in tropical America, and colonised in many places.

Cassia glandulosa, *L.*—V. 62, 762, 1044, 1187; B. 275. Widely dispersed in tropical America.

Cassia glauca, *Lam.*—V., Guilding. Introduced from the Old World. A native of tropical Asia and Australia.

Cassia hirsuta, *L.*—V. 1052. Widely dispersed in tropical America, from Mexico southward.

Cassia multijuga, *Rich.*—V., Guilding. Widely spread in tropical America, from Mexico to South Brazil.

Cassia nictitans, *L.*—V. 782. North America, from Indiana and Pennsylvania to the West Indies, Mexico, Venezuela and Guiana.

Cassia obovata, *Collad.*—U. 11. Introduced from the Old World, where it inhabits tropical Africa and extends eastward to North-west India.

Cassia occidentalis, *L.*—V. 8*a*, B. 266. Now cosmopolitan in the tropics, but probably of American origin.

Cassia Tora, *L.*—V. 477, 824, 1118; B. 267. Common in nearly all warm countries of the globe.

Cassia viminea, *L.*—V., Guilding. West Indies and eastern tropical America.

Dialium guineense, *Willd.*—V., Guilding. A West African tree, probably only cultivated in St. Vincent.

Bauhinia Kappleri, *Sagot.*—V. 571. St. Thomas and Guiana.

Bauhinia megalandra, *Griseb.*—V. 273. Trinidad, and Grisebach records it from Cuba, St. Kitts, and Antigua.

Bauhinia ungula, *Jacq.*—C. 11. Jamaica, and Grisebach records it from St. Thomas, Venezuela, and New Granada.

Brownea Rosa-de-Monte, *Berg.*—V., Guilding. Tobago. Grisebach also records it from Venezuela.

Brownea speciosa, *Reichb.*—V., Guilding. Grisebach also records it from Trinidad.

Tamarindus indica, *L.*—V. 795; B. 273; M. 107. Introduced from the Old World, where it is also largely cultivated. It is supposed to be indigenous in tropical Africa.

Hymenæa Courbaril, *L.*—V. 895; B. 269, 270; M. 113, 114. Widely dispersed in tropical America from Mexico southward.

Copaifera, *sp.*—V. 1628.

Pentaclethra filamentosa, *Benth.*—V., Guilding. Trinidad and tropical America, from Nicaragua to Guiana and North Brazil.

Entada polyphylla, *Benth.*—V. 71. Tropical America, from eastern Peru through Guiana and North Brazil.

Entada polystachya, *DC.*—V., Guilding. West Indies and tropical America, from Mexico to Columbia, Guiana, and North Brazil.

Entada scandens, *Benth.*—V. 668. Generally dispersed in the tropics, especially near the sea.

Piptadenia peregrina, *Benth.*—V., Anderson. Trinidad and tropical America, from Venezuela and Guiana to South Brazil.

Adenanthera pavonina, *L.*—V. 893; B. 333. Introduced from tropical Asia, where it has a wide range.

Neptunia plena, *Benth.*—V., Guilding; U. 2. West Indies and tropical America, from South Mexico to Ecuador and Paraguay. Naturalised in India.

Desmanthus depressus, *H. B.K.*—V. 1040; C. 25; M. 98, 104. Widely dispersed in the warmer parts of America, from Florida and Texas, through Mexico and the West Indies to Peru and South Brazil.

Desmanthus virgatus, *Willd.*—V. 555; B. 281, 282; M. 95. Tropical and sub-tropical America and tropical Asia, from Mexico and the West Indies to Buenos Ayres.

Mimosa asperata, *L.*—V. 658. Widely dispersed in tropical and sub-tropical America and Africa, and in the Mascarene Islands.

Mimosa casta, *L.*—V. 562. Martinique, Trinidad and North Brazil.

Mimosa Ceratonia, *L.*—V. 553. St. Thomas, Porto Rico, Dominica, Martinique and St. Lucia, and Grisebach records it from Antigua.

Mimosa polydactyla, *Humb.*—V. Guilding. Tropical America, in Columbia, Guiana and Brazil.

Mimosa pudica, *L.*—V. 12, 897. A common weed throughout tropical America, and widely naturalised in the Old World.

Schranckia leptocarpa, *DC.*—V. 1006. Tropical America, from Columbia to Guiana and Brazil. Found also in tropical Africa and Java, where it is probably introduced.

Leucæna glauca, *Benth.*—V. 181, 853; B. 271; M. 106. Common in the warmer regions of both hemispheres, but probably of American origin.

Acacia arabica, *Willd.*—V. 564, 906; C. 26; M. 108; U. 3. Introduced from Africa.

Acacia farnesiana, *Willd.*—V. 901. Universally dispersed in the warmer regions of both hemispheres, but introduced or cultivated in many localities.

Acacia riparia, *H. B.K.*, syn. A. sarmentosa, *Griseb.* (*vix Desv.*) —V. 1903. West Indies and tropical America, from Columbia to Guiana and Brazil.

Acacia Suma, *Kurz*, syn. A. Catechu, *Griseb.* (*vix Willd.*)—V. 942, 1904. Introduced from the East Indies.

Acacia tamarindifolia, *Willd.*—V., Guilding; M. 110. Martinique, St. Lucia, Venezuela and Columbia.

Lysiloma, three undetermined species.—V. 821, V. 1186, and C. 24.

Calliandra Guildingii, *Benth.*—V., Guilding. Trinidad, but there introduced, according to Lane, in Grisebach's flora of the British West Indian islands.

Calliandra purpurea, *Benth.*—V. 1000; B. 285. West Indies and Guiana.

Calliandra tergemina, *Benth.*—V. Guilding. West Indies and Venezuela.

Albizzia Lebbek, *Benth.*, syn. Acacia Lebbek, *Willd.*—V. 999; B. 279. Introduced from the Old World, where it has a very wide range in the tropics.

Pithecolobium latifolium, *Benth.*, syn. Calliandra latifolia, *Griseb.*—V. 1037. West Indies and tropical South America, in the northern part, from Panama eastward.

Pithecolobium micradenium, *Benth.*—V. 222, 285, 297. Jamaica, Dominica and St. Lucia.

Pithecolobium Unguis-cati, *Benth.*—V. 1634; B. 274; M. 109; U. 7, also Powell 96. Florida, West Indies, Columbia and Venezuela.

Pithecolobium tortum, *Mart.*, syn. Acacia Vincentis, *Griseb.*—V., Guilding. West Indies and tropical America to Columbia, Guiana, and South Brazil.

Pithecolobium, *sp.*—V. 902.

Enterolobium cyclocarpum, *Griseb.*—V. without number. West Indies, Nicaragua, Columbia and Venezuela.

Inga ingoides, *Willd.*—V. 34. West Indies and tropical America.

Inga laurina, *Willd.*—V. 677, 1047, 1912. West Indies and Veraguas.

ROSACEÆ.

Chrysobalanus Icaco, *L.*—V. 198. West Indies and South Mexico to Panama and eastern South America.

Chrysobalanus pellocarpus, *Mey.*—V., Guilding. West Indies and Guiana.

Licania ternatensis, *Hook. f.*, syn. L. hypoleuca, *Griseb.* (*non Benth.*). —V. 1730. Dominica and Trinidad. Quite distinct from *L. hypoleuca*, Benth., with which Grisebach confounds it.

Moquilea, *sp.*—V. 478, 1566, 1838.

Hirtella paniculata, *Sw.*—V., Guilding. Trinidad and Guiana.

Hirtella racemosa, *Lam.*—V., Guilding. Trinidad and tropical America, from Panama eastward to Guiana.

Hirtella triandra, *Sw.*—V. 748. West Indies and tropical America, from Panama eastward and southward in Brazil.

Prunus occidentalis, *Sw.*—V., Guilding. Jamaica, Cuba, Guatemala and Panama.

Prunus sphærocarpa, *Sw.*, syn. P. pleuradenia, *Griseb.*—V., Guilding. West Indies and East tropical America.

Rubus rosæfolius, *Sm.*—V. 894. A native of North India and China, commonly cultivated and naturalised in other countries.

SAXIFRAGACEÆ.

Weinmannia pinnata, *L.*—V. 31. Mexico, West Indies and Guiana.

CRASSULACEÆ.

Bryophyllum calycinum, *Salisb.*—V. 9, 1586; B. without number; M. 1. Naturalised in tropical America and many other warm countries, and probably native only in Africa.

RHIZOPHOREÆ.

Rhizophora Mangle, *L.*—V., Guilding. Shores of tropical America, West Africa and Polynesia.

Cassipourea elliptica, *Poir.*—V. 679, 938, 1287, 1727, 1728, 1729, 1730. West Indies and northern part of tropical South America.

COMBRETACEÆ.

Terminalia Buceras, *Baill.*, syn. Bucida Buceras, *L.*—V. 887. South Florida, West Indies, Central America and northern part of South America.

Terminalia Catappa, *L.*—V. 69, 1798. Introduced from tropical Asia, where it has a wide area. Commonly cultivated.

Terminalia latifolia, *Sw.*—B. 127. Jamaica and Trinidad.

Conocarpus erectus, *Jacq.*—V., Guilding; B. 66, 67; U. 18. Widely dispersed on the coasts of tropical America and the Galapagos Islands; also in West tropical Africa, and Grisebach records it from the Marianne Islands.

Laguncularia racemosa, *Gærtn.*—V., Guilding; B. 64, 84; C. 3; M. 132. West Indies, and along the Atlantic coast of tropical America; also in West tropical Africa.

Combretum eriopetalum, *G. Don.*—V., Guilding. Trinidad.

Quisqualis indica, *L.*—V. 1892. Introduced from the Old World. Cultivated in tropical countries generally, and believed to be native of Malaya.

MYRTACEÆ.

Psidium Guyava, *Raddi.*—V. 827; B. 68. West Indies and tropical America; now widely naturalised in warm countries.

Psidium guildingianum, *Griseb.*—V., Guilding. Not known from elsewhere.

Myrcia coriacea, *DC.*—V. 338, 851, 1802; B. 81. From Cuba and Porto Rico to Trinidad.

Myrcia divaricata, *DC.*—V. 1734. West Indies and tropical America.

Myrcia ferruginea, *DC.*, syn. M. crassinervia, *DC.* and M. duchassaingiana, *Berg.*—V. 259, 643, 1758, 1759, 1760, 1761. These three are clearly forms of one and the same species. West Indies, Guiana and Venezuela.

Myrcia splendens, *DC.*—V. 400. West Indies and tropical America.

Myrcia, three undetermined species.—V. 1751, 1752, and 1733, the genus of the latter somewhat doubtful.

Pimenta acris, *Wight et Arn.*—V. 1289, 1289*a*; B. 15. West Indies and tropical America; also much cultivated and naturalised in the East Indies.

Eugenia baruensis, *Jacq.*—V. 904, 1746, 1747; B. 72. Cuba and Jamaica to Trinidad.

Eugenia caryophyllata, *Thunb.*, syn. Caryophyllus aromaticus, *L.*—V., Guilding. Introduced from the Moluccas and now naturalised.

Eugenia coffeifolia, *DC.*—V., Forsyth (Griseb.). Dominica and Guiana.

Eugenia Jambolana, *Lam.*, syn. Syzygium Jambolanum, *DC.*—V. 1562. Introduced from the East Indies. Commonly cultivated, and wild from tropical India to North Australia.

Eugenia Jambos, *L.*, syn. Jambosa vulgaris, *DC.*—V. 780, 819. Introduced from the Old World. Extensively cultivated, and found wild from North India to Australia.

Eugenia lambertiana, *DC.*—V., Lambert (DC.). Grisebach also records it from Guadeloupe and Panama.

Eugenia ligustrina, *Willd.*—V. 1552; B. 82. West Indies and East tropical America.

Eugenia malaccensis, *L.*, syn. Jambosa malaccensis, *DC.*—V. 1517. Introduced from the Old World. A native of Malaya, of which there are many varieties in cultivation.

Eugenia marchiana, *Griseb.*—V., Anderson (Griseb.). Jamaica and Trinidad.

Eugenia obtusata, *Willd.*—V. 1524. Jamaica and Dominica.

Eugenia pseudopsidium, *Jacq.*—V. 487, 1559, 1756. Dominica and Martinique.

Eugenia uniflora, *L.*—V., Guilding. West Indies and East tropical America.

Eugenia, two or three undetermined species.—V. 1531, 1558, 1735, 1737, 1738; B. 133, 145. The genus is somewhat doubtful in one or two instances owing to imperfect material.

Barringtonia speciosa, *Forst.*—V. 596. Introduced from the Eastern tropics.

Gustavia antillana, *Miers.*—V., Guilding. Not known from elsewhere.

Couroupita antillana, *Miers.*—V. 1516. Trinidad.

MELASTOMACEÆ.

Nepsera aquatica, *Naud.*—V., Anderson. West Indies and tropical America.

Pterolepis glomerata, *Miq.*, syn. Arthrostemma glomeratum, *Naud.*—V. 360. West Indies and tropical America.

Tibouchina cistoides, *Cogn.*, syn. Chætogastra cistoides, *Griseb.*—V. 135. Not known from elsewhere.

Tibouchina longifolia, *Baill.*, syn. Arthrostemma lanceolatum, *Griseb.*—V. 128. Widely dispersed in tropical America.

Aciotis discolor, *D. Don.*, syn. Spennera pellucida, *Griseb.*, pro parte (*non DC.*).—V., Anderson. Martinique and Trinidad.

Graffenriedia latifolia, *Triana*, syn. Cycnopodium latifolium, *Naud.*—V. 787. West Indies, Venezuela and Columbia.

Tetrazygia discolor, *DC.*—V. 47, 121. West Indies and French Guiana.

Charianthus coccineus, *D. Don.*—V. 146. West Indies and French Guiana.

Charianthus glaberrimus, *DC.*—V., Eggers (Cogniaux). Dominica to Trinidad and French Guiana.

Conostegia calyptrata, *D. Don.*—V. 994. Montserrat, Guadeloupe, Dominica and Martinique.

Conostegia subhirsuta, *DC.*—V. 489. Widely dispersed in tropical America.

Miconia ciliata, *DC.*, syn. M. racemosa var. ciliata, *Griseb.*—V., Anderson. West Indies and tropical America.

Miconia cinnamomifolia, *Triana*, syn. Tetrazygia cornifolia, *Griseb.*—V., Guilding. Montserrat, Dominica, Martinique and St. Lucia.

Miconia Fothergilla, *Naud.*, syn. Diplochita Fothergilla, *DC.*—V. 534. West Indies and Eastern tropical America.

Miconia elongata, *Vahl.*, syn. Tetrazygia semicrenata, *Naud.*—V. 174, 720, 749, 820, 988, 1853; B. 35. Montserrat, Guadeloupe, Dominica, Martinique and Grenada.

Miconia lævigata, *DC.*—V. 622, 905, 1608; B. 33, 34. Widely dispersed in tropical America.

Miconia longifolia. *DC.*, syn. Chænopleura longifolia, *Griseb.*—V. Anderson. Trinidad and tropical America.

Miconia trinervia, *D. Don.*—V. 286, 1215, 1855. Jamaica and Grenada.

Miconia virescens, *Triana*, syn. M. lævigata, *Griseb.*, in part.—V., Eggers (Cogniaux). Tobago, Trinidad and Venezuela.

Clidemia domingensis, *Cogn.* — V. Eggers (Cogniaux). San Domingo and Porto Rico.

Clidemia guadeloupensis, *Griseb.*, syn. C. Swartzii, *Griseb.*, pro parte.—V., Guilding. Guadeloupe and Dominica.

Clidemia hirta, *D. Don.*—V. 59. Widely dispersed in tropical America.

Henriettella triflora, *Triana.*—V. 462. St. Lucia.

Blakea pulverulenta, *Vahl.*—V. 734, 734*a*. Montserrat, Guadeloupe, Dominica, and Martinique.

Mouriria rhizophoræfolia, *Triana*, syn. Olisbea rhizophoræfolia, *DC.*—V. cultivated (Caley). Martinique and Trinidad.

LYTHRARIEÆ.

Ammannia latifolia, *L.*—V. 1597. Widely dispersed in the warmer parts of America.

Cuphea Melvilla, *Lindl.*—V. Guilding. East tropical America. Grisebach supposes it to be introduced in St. Vincent.

Cuphea parviflora, *Hook.*, syn. C. trinitatis, *DC.*—V., Guilding. Tobago, Trinidad, and Guiana.

Lagerstrœmia Flos-Reginæ, *Retz.*—V. 925. Introduced from tropical Asia.

Punica Granatum, *L.*—V. 1531. Introduced from the Old World.

ONAGRARIEÆ.

Jussiæa linifolia, *Vahl.*, syn. J. acuminata, *Sw.*—V. 51. Almost universally diffused within the tropics.

Jussiæa suffruticosa, *L.*—V. 296, 318, 439; B. 178. Very widely dispersed in warm countries.

SAMYDACEÆ.

Casearia parvifolia, *Willd.*—V. 816, 1269, 1849. West Indies and East tropical America.

Casearia ramiflora, *Vahl.*—V. 940, 1269, 1561. West Indies and East tropical America.

Samyda serrulata, *L.* — V. (Grisebach). Jamaica and Cuba to Trinidad.

TURNERACEÆ.

Piriqueta cistoides, *Mey.*—V. 1228. West Indies and East tropical America.

PASSIFLOREÆ.

Passiflora fœtida, *L.*—V. 796; B. 310. Widely dispersed in the tropics of both hemispheres, though probably introduced in the eastern.

Passiflora laurifolia, *L.*—V. 236; B. 132; M. 42. West Indies and East tropical America.

Passiflora peltata, *Cav.*—V., Guilding. San Domingo.

Passiflora quadrangularis, *L.*—V. 183. Introduced. Said to be indigenous in Nicaragua. Widely cultivated.

Passiflora rotundifolia, *L.*—V. 654, 732, 1876. Martinique and Brazil.

Passiflora rubra, *L.*—V. 607. West Indies and tropical America.

Passiflora serrata, *L.*—V. 1312. West Indies and tropical America.

Passiflora suberosa, *L.*—V. 615, 1314, 1315, 1616, 1868, 1869; B. 315, 316; M. 41. Very widely diffused in the warmer parts of America.

Carica Papaya, *L.*—V. 505; B. 97. Tropical America, now cultivated in most tropical countries.

CUCURBITACEÆ.

Lagenaria vulgaris, *Ser.*—V. 625. Introduced from the Old World, now widely cultivated in the tropics.

Luffa cylindrica, *Rœm.*, syn. L. acutangula, *Roxb.*—V. 407, 1310. Introduced from the Old World.

Momordica Charantia, *L.*—V. 65. Widely dispersed in the warmer countries of the globe, but probably introduced in America.

Cucumis Anguria, *L.*—V. 1368. West Indies and tropical America.

Citrullus vulgaris, *Schrad.*—V. 378; B. 326. Native of Africa, now universally cultivated in warm countries.

Melothria pervaga, *Griseb.*—V. 590. West Indies and tropical America.

Anguria umbrosa, *H. B.K.* — V. 234, 1870, 1872. Trinidad and tropical America.

Sicydium tamnifolium, *Cogn.*—V. 716. Cuba and tropical America.

Ceratosanthes tuberosa, *Spreng.*—B. 314; M. 36, 43. West Indies and Venezuela.

Cayaponia americana, *Cogn.*, syn. Cionandra cuspidata and C. graciliflora, *Griseb.*—V. 280, 500, 572, 702, 1303. West Indies, common, and Central America.

Sechium edule, *Sw.*—V. 1621. West Indies and tropical America.

BEGONIACEÆ.

Begonia dominicalis, *A. DC.*—V. 180, 180*a*, 274, 274*a*, 984. Dominica.

Begonia martinicensis, *A. DC.*—V., Caley (A. DC.)—Martinique.

Begonia rotundifolia, *Lam.*—V., Guilding. Not certainly known from elsewhere, as Plumier's earlier habitat is vaguely stated as "America meridionalis."

Begonia, two or three undetermined species.—V. 1191, 1192, 1193, 1605, 1934, 1935; B. 11.

CACTEÆ.

Pereskia aculeata, *Mill.*—B. without number. West Indies and East tropical America.

FICOIDEÆ.

Sesuvium Portulacastrum, *L.*—V. 468; B. 6; C. 10. Very widely dispersed on seashores in tropical and subtropical countries.

Trianthema monogynum, *L.*—V. without number; C. 14. Widely dispersed in the tropics.

Mollugo verticillata, *L.*—V. 404. Widely dispersed in the warmer parts of America.

UMBELLIFERÆ.

Eryngium fœtidum, *L.*—V. 256. West Indies and tropical America, and in West tropical Africa, where it may have been introduced.

Fœniculum vulgare, *L.*—V. 1588, 1589. Introduced from the Old World.

ARALIACEÆ.

Didymopanax glabratum, *Dene & Planch.*, syn. Panax attenuatum, *Sw.*—V. 731. West Indies and Venezuela.

Oreopanax capitatum, *Dene & Planch.*, syn. Sciadophyllum capitatum, *Griseb.*—V. 131, 155. West Indies and tropical America.

CAPRIFOLIACEÆ.

Sambucus canadensis, *L.*—V. 1267. Possibly introduced from North America, but it also inhabits Mexico.

RUBIACEÆ.

Manettia coccinea, *Griseb. (non Willd.)*.—V. 730. West Indies, Guiana, Venezuela and Peru.

Hillia parasitica, *Jacq.*, syn. H. longiflora, *Sw.*—V. 725. West Indies and tropical America.

Exostemma caribæum, *Rœm. et Schult.*—V. 1284, 1530; B. 111; M. 147. West Indies and tropical America.

Exostemma floribundum, *Rœm. et Schult.*—V. 122. San Domingo, Dominica, Martinique and St. Lucia.

Chimarrhis cymosa, *Jacq.*—V. 889, 1245, 1792. Jamaica, Cuba, Antigua, Dominica, Martinique and St. Lucia.

Rondeletia americana, *L.*—V. 778, 1240, 1317, 1831. Grisebach also records it from Jamaica and Cuba.

Rondeletia arborescens, *Griseb.*—V. 726. Dominica, Martinique and St. Lucia.

Rondeletia hirsuta, *Sw.*—V., Anderson. Jamaica, and Grisebach also records it from St. Thomas.

Oldenlandia corymbosa, *L.*—V. 316, 529. Widely dispersed in the tropics.

Isertia coccinea, *Vahl.*—V., Guilding. East tropical America.

Gonzalea spicata, *DC.*—V. 592; B. 113. West Indies and tropical America.

Schradera capitata, *Vahl.*—V. 1741. Porto Rico, Montserrat, Dominica, Martinique and St. Lucia.

Hamelia patens, *Jacq.*—V. 1247, 1541. West Indies and tropical America.

Hoffmannia tubiflora. *Griseb.*—V. 419. Not known from elsewhere.

Basanacantha spinosa, *Schumann*, syn. Randia armata, *DC.*—V. 1526, 1851. West Indies and tropical America.

Posoqueria latifolia, *Rœm. et Schult.*—V., Guilding. East tropical America.

Randia aculeata, *L.*—V. 1526, 1851; B. 86; C. 5; M. 149. South Florida and West Indies.

Randia Mussændæ, *DC.*—V., Guilding. West Indies and tropical America.

Genipa americana, *L.*—V. 632; B. 115; M. 154. West Indies and tropical America.

Genipa Caruto, *H. B.K.*—V. 1793. West Indies and tropical America. Probably only a variety of the preceding with the leaves hairy underneath.

Guettarda crispiflora, *Vahl.*—V. 82. Dominica, and Grisebach records it from Jamaica, Montserrat and the French islands.

Guettarda odorata, *Lam.*—V. 833, 1242*a*, 1854; B. 75, 76; M. 150. Central America and West Indies.

Guettarda scabra, *Lam.*—V. 631, 1547, 1829, 1830; B. 60, 61; M. 144. West Indies and tropical America.

Antirrhœa acutata, *Benth. et Hook. f. Gen. Pl.*, II., p. 100 (sphalmate "*aristata*"), syn. Stenostomum acutatum, *DC.*—V. 756, 911. Guadeloupe.

Chomelia fasciculata, *Sw.*—V. 856, 1242; B. 78. Grenada and Brazil.

Malanea macrophylla, *Bartl.*—V. 633, 909, 1825, 1826. Trinidad and Guiana.

Erithalis angustifolia, *DC.*—V., Guilding. Cuba.

Erithalis fruticosa, *L.*—V. 393; B. 41, 42; M. 161. South Florida, Central America and West Indies.

Chiococca parvifolia, *Wullschl.*—V. 1806, 1828; B. 48. West Indies and tropical America.

Chione glabra, *DC.*—V. 635. Porto Rico, Dominica and Grenada, and Grisebach records it from Montserrat and Guadeloupe.

Ixora ferrea, *Benth.*—V. 442, 542, 1827. West Indies and tropical America.

Morinda citrifolia, *L.*—V. 701. Introduced from tropical Asia.

Coussarea *sp.*—V. 1236, 1237, 1746.

Faramea odoratissima, *DC.*—V. 497, 1235. West Indies and tropical America.

Psychotria crassa, *Benth.*—V. 1243. West Indies and tropical America.

Psychotria floribunda, *H. B.K.*—V. 826, 1246. Guadeloupe, Dominica, Martinique, St. Lucia and New Grenada.

Psychotria glabrata, *Sw.*—V., 576, 1537. Jamaica, Cuba and Porto Rico, and Grisebach records it from Antigua.

Psychotria horizontalis, *Sw.*—V., Guilding; B. 110. West Indies and tropical America.

Psychotria lanceolata, *Nutt.*—V., Guilding. South Florida and West Indies.

Psychotria Mapouria, *Rœm. et Schult.* — V. 1767. Dominica, Martinique and Guiana.

Psychotria parasitica, *Sw.*—V. 17. Jamaica, Cuba, Porto Rico, Dominica, Martinique, and Grisebach records it from Montserrat and St. Kitts.

Psychotria platyphylla, *DC.*—V. 537, 1791; B. 117. Jamaica, Porto Rico, Dominica, Martinique and St. Lucia.

Psychotria pyramidalis, *Griseb.*—B. 118. Cuba and San Domingo.

Psychotria uliginosa, *Sw.*, syn. P. uliginosa var. α, *Griseb.**—V. 427. Jamaica, Cuba, Porto Rico, Dominica, Martinique, St. Lucia, Trinidad, and Grisebach records it from Central America and Guiana.

Psychotria undata, *Jacq.*—V. 1238, 1239; B. 26, 28. Central America and West Indies.

Palicourea crocea, *DC.* — V. 334. West Indies and tropical America.

Rudgea caribæa, *Benth.*—V. 261, 464. Dominica, Martinique and St. Lucia, and Grisebach records it from Jamaica, Antigua and Guadeloupe.

Geophila reniformis, *Don.*—V. 444. Widely dispersed in the tropics.

Cephaelis muscosa, *Sw.*—V. 640. West Indies and East tropical America.

Diodia rigida, *Cham. et Schlecht.*—V. (Grisebach). West Indies and tropical America.

Spermacoce tenuior, *Lam.*—V. 1210, 1211; B. 9, 10, 189; U. 20. West Indies, Central America and Brazil.

Borreria lævis, *Griseb.*—V. 84, 370, 655, 788, 989, 1209; B. 190; M. 15. West Indies and tropical America.

Borreria ocimoides, *DC.*, syn. B. parviflora, *Mey.*—V. 501, 990. Widely dispersed in the tropics.

Mitracarpum hirtum, *DC.*, syn. M. villosum, *Cham. et Schlecht.*—V., Guilding. West Indies and tropical America; also Marianne and Society Islands.

COMPOSITÆ.

Vernonia arborescens, *Sw.*—V. 210; B. 297. West Indies and Central America.

Vernonia tricholepis, *DC.*—B. 288. West Indies and tropical America.

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* Grisebach's var. β is a quite distinct species, and may be defined as follows:—

Psychotria discolor, *Rolfe*, syn. P. uliginosa var. discolor, *Sm.*, *ex Griseb. Fl. Brit. W. Ind.*, p. 340. — Foliis minute puberulis, cymis subsessilibus densis puberulis. Fructibus multo minoribus.

Vernonia, two undetermined species.—V. 359, 922.

Elephantopus angustifolius, *Sw.*—V. 1231. West Indies and tropical America.

Elephantopus mollis, *H. B.K.* — V. 223. West Indies and tropical America.

Elephantopus spicatus, *Aubl.*, syn. Distreptus spicatus, *Cass.*—V. 126, 552, 1202, 1203; B. 287. Widely dispersed in tropical America.

Rolandra argentea, *Rottb.*—V. 1212. West Indies and tropical America.

Adenostemma Swartzii, *Cass.*—V. 954. West Indies and tropical America.

Ageratum conyzoides, *L.*—V. 227, 543. Widely dispersed in the tropics.

Eupatorium celtidifolium, *Lam.*—V. 806. West Indies and tropical America.

Eupatorium iresinoides, *H. B.K.* — V. 107, 870. West Indies and tropical America.

Eupatorium macrophyllum, *L.*, syn. Hebeclinium macrophyllum, DC.—V. 86, 699, 1929. West Indies and tropical America.

Eupatorium odoratum, *L.*—V. 94; M. 83. West Indies and tropical America.

Eupatorium ossæanum, *DC.*—V. 331, 410. Cuba. Originally described from a Cuban specimen, but at Kew it is only represented from St. Vincent.

Mikania imrayana, *Griseb.*—V. 1890. Dominica.

Mikania orinocensis, *H. B.K.*—V. 264. West Indies and tropical America.

Mikania, two undetermined species.—V. 20, 1227.

Egletes domingensis, *Cass.*—V. 204. West Indies and tropical America.

Erigeron apurensis, *Griseb.*—V. 568, 657, 738. West Indies and tropical America.

Erigeron bonariensis, *L.*—V. 284, 308, 1008, 1931; B. 206, 329, Widely dispersed in tropical America.

Erigeron canadensis, *L.*—V. 568, 657, 738. Originally American, now an almost cosmopolitan weed.

Baccharis speciosa, *DC.*—V. 1226. Dominica and Martinique.

Pluchea odorata, *Cass.*—V. 160, 1927. West Indies and tropical America.

Lagascea mollis, *Cav.*— V. 808, 898. Mexico and tropical America.

Clibadium asperum, *DC.*—V., Guilding. West Indies and tropical America.

Clibadium erosum, *DC.*—V. 536, 1230. West Indies and tropical America.

Clibadium fragiferum, *Griseb.*—V. 627. Costa Rica, and Grisebach records it from Guadeloupe.

Parthenium Hysterophorus, *L.*—V. 152; B. 299; M. 80. Widely dispersed in the warmer parts of America.

Zinnia elegans, *Jacq.*—V., Guilding. A Mexican plant now naturalised in various countries.

Eclipta erecta, *L.*, syn. E. alba, *Hassk.*—V. 526; B. 304. Widely dispersed in the warmer countries of the globe.

Wulffia stenoglossa, *DC.*, syn. **Wulffia havanensis**, *DC.*—V. 285. West Indies and tropical America.

Wedelia buphthalmoides, *Griseb.*—V. 299, 1224, 1225; B. 294, 295; M. 84.

Wedelia carnosa, *Rich.*—V. 351, 1223. West Indies and tropical America.

Eleutheranthera ovata, *Poit.*, syn. Ogiera ruderalis, *Griseb.*—V. 723*a*; B. 205. West Indies and tropical America.

Tithonia tagetiflora, *Desf.*—V. 1222. South Mexico and Guatemala. Sparingly naturalised in St. Vincent.

Melanthera deltoidea, *Rich.*—V. 49, 81, 330, 369; B. 203; U. 37. West Indies and tropical America.

Spilanthes Acmella, *L.*, syn. S. uliginosa, *Sw.* and S. exasperata, *Jacq.*—V. 96, 1592. West Indies and tropical America.

Spilanthes urens, *Jacq.*—V., Guilding. West Indies and tropical America.

Synedrella nodiflora, *Gærtn.*—V. 50, 195, 205, 723, 1219. West Indies and tropical America.

Cosmos caudatus, *H. B.K.*—V. 3. Widely dispersed in tropical America.

Bidens bipinnatus, *L.*—V. 305. Widely dispersed in the warmer countries of the globe.

Bidens rubifolius, *H. B.K.*, syn. Bidens Coreopsidis, *DC.* V. 1220. Dispersed throughout tropical America.

Bidens pilosa, *L.*, syn. B. leucantha, *Willd.*—V. 466, 669. Widely dispersed in the warmer countries of the globe.

Porophyllum ruderale, *Cass.*—V. 718; B. 292. West Indies and tropical America.

Tagetes erecta, *L.*—V. 1221. South Mexico; now naturalised in various tropical countries.

Pectis humifusa, *Sw.*—V. 203; M. 24. Jamaica, Porto Rico, Guadeloupe, Dominica, Martinique and St. Lucia.

Pectis punctata, *Jacq.*—V. 1232; B. 300; U. 23, 24. West Indies and tropical America.

Neurolæna lobata, *R. Br.*—V. 502. West Indies and tropical America.

Erechthites hieracifolia, *Rafin.*—V. 618; 660. Widely dispersed in the warmer parts of America.

Emilia sonchifolia, *DC.*—V. 63, 98, 229, 672; B. 291; M. 82. Introduced from the Old World.

Chaptalia nutans, *Hemsl.* syn. Leria nutans, *DC.*—V. 706; B. 290. Widely dispersed in the warmer parts of America.

Sonchus oleraceus, L.—V. 880, M. 81. A cosmopolitan weed.

CAMPANULACEÆ.

Centropogon surinamensis, *Presl.*—V. (Grisebach). Trinidad and Panama to Brazil and Peru.

Lobelia (§ Tupa) cirsiifolia, *Lam.*—V., Guilding. Jamaica and St. Kitts.

Lobelia (§ Tupa) sp.—V. 750 and 750*a.* Grisebach also mentions an undetermined species related to *Tupa flavescens, A.DC.*

PLUMBAGINEÆ.

Plumbago scandens, *L.*—V. 510; B. 140. Florida ("perhaps introduced from West Indies," A. Gray), Mexico, Central America, and West Indies to Brazil and Chili, also the Galapagos Islands.

MYRSINEÆ.

Myrsine coriacea, *R. Br.*—V. 1534. West Indies.

Myrsine læta, *A. DC.*—V. 139. West Indies. Grisebach includes with this species *M. myricoides,* Schlecht. and *M. flocculosa,* Mart., thus extending the distribution from Mexico to Brazil.

Grammadenia parasitica, *Griseb.*—V. 1254. Dominica and Guadeloupe.

Conomorpha peruviana, *A. DC.*—V. 1286, 1748. Dominica and St. Lucia, Venezuela, Guiana and Peru.

Ardisia caribæa, *Miq.*—V. (Grisebach). West Indies.

Ardisia laurifolia, *Juss.*—V. 541, 1570. West Indies.

Jacquinia armillaris, *L.*—V. 506; C. 6; M. 146. Eastern Florida, Nicaragua and West Indies to Venezuela and Brazil.

SAPOTACEÆ.

Chrysophyllum Cainito, *L.*—V. 1762. West Indies, Panama, Guiana, Columbia and Peru.

Chrysophyllum glabrum, *Jacq.*—V. 912, 1283, 1756, 1803. West Indies and Guiana.

Chrysophyllum microphyllum, *Jacq.?*—V. 755, 1753. West Indies.

Lucuma multiflora, *A. DC.*—V. 472, 1535, 1785. Jamaica and St. Lucia.

Sideroxylon, an undetermined species.—V. without number.

Achras Sapota, *L.*, syn. Sapota Achras, *Mill.*—V. 1576; B. 108. Mexico and West Indies to north part of South America. Commonly cultivated for its fruit in America and elsewhere.

Mimusops dissecta, *R. Br.*—V., Guilding. Bahamas and Trinidad, also in the Pacific Islands.

Mimusops Kauki, *L.*—V., Guilding. Naturalised in St. Vincent, according to Grisebach. Malayan Peninsula and Archipelago, also tropical Australia.

EBENACEÆ.

Maba inconstans, *Griseb.*—V., Guilding; B. 152. New Grenada.

Diospyros, species undetermined.—B. 45.

STYRACEÆ.

Symplocos martinicensis, *Jacq.*—V. 354. West Indies.

Styrax, species undetermined.—V. 1656.

OLEACEÆ.

Forestiera rhamnifolia, Griseb.—V. without number. Cuba.

Linociera compacta, *R. Br.*—V. 626, 1568; B. 30, 31. West Indies, Venezuela and Brazil.

Linociera, species undetermined.—V. 1841.

APOCYNACEÆ.

Allamanda cathartica, *L.*—V. 996. West Indies (naturalised and cultivated according to Grisebach) and Central America to Peru and Brazil.

Rauwolfia Lamarckii, *A. DC.*—V. 557; B. 27; M. 141. West Indies and Ecuador.

Thevetia neriifolia, *Juss.*—V. 810. Common in many parts of tropical America and the West Indies, but often cultivated.

Aspidosperma sessiliflorum, *Muell. Arg.*—V., Guilding. Trinidad.

Vinca rosea, *L.*—V. 175; B. 195. Florida and West Indies, to Brazil, also tropical Africa and Asia to China.

Plumeria alba, *L.*—V. 550, 678; B. 99; M. 163. West Indies.

Tabernæmontana citrifolia, *L.*—V. 38; B. 29. West Indies.

Tabernæmontana undulata, *Vahl.*—V., Guilding; perhaps cultivated (Grisebach); Trinidad and Guiana.

Malouetia retroflexa, *Muell. Arg.*—V., Guilding. Confined to St. Vincent, so far as at present known.

Prestonia venosa, *Rolfe,* syn. Hæmadictyon venosum, *Lindl.*—V. (Grisebach). West Indies and New Grenada.

Echites circinalis, *Sw.*—V., Guilding. Haiti.

Rhabdadenia biflora, *Muell. Arg.*, syn. Echites biflora, *Jacq.*—B. 70, 328. West Indies, Venezuela and Guiana to Brazil.

Urechites Neriandra, *Rolfe,* syn. Echites Neriandra, *Griseb.*—V., Andrews. West Indies.

ASCLEPIADEÆ.

Macroscepis, *n. sp.* ?—V. 1862.

Oxypetalum, species undetermined.—V. 1617.

Calotropis procera, *R. Br.*—U. 25. Introduced into tropical America from the Old World.

Asclepias curassavica, *L.*—V. 770; M. 4. Common in nearly all warm countries.

Metastelma parviflorum, *R. Br.*—V. 1295. West Indies and Mexico to Columbia.

Roulinia? Two undetermined species doubtfully referred to this genus.—V. 803, 1618; M. 39.

Gonolobus martinicensis, *Dcne.*—V. 382. Dominica and Martinique.

Gonolobus maritimus, *R.Br.*, syn. Ibatia muricata, *Griseb.*—V. 1300; B. 324, 325. Antigua, Dominica, Guadeloupe and Venezuela.

LOGANIACEÆ.

Spigelia Anthelmia, *L.*—V. 179; B. 221; M. 6. Common and widely dispersed in tropical America.

GENTIANEÆ.

Voyria tenella, *Guild.*—V., Guilding. Jamaica.

Voyria uniflora, *Lam.*—V. 440. West Indies and Guiana to South Brazil and New Granada.

Enicostema littorale, *Bl.*, syn. Slevogtia occidentalis, *Griseb.*—V. 319; B. 188. West Indies, also India, Malaya and tropical Africa.

Coutoubea spicata, *Aubl.*—V. 684. Trinidad and Central America to Columbia, Guiana and Brazil.

Lisianthus frigidus, *Sw.*—V. 18. Dominica and Guadeloupe.

Lisianthus uliginosus, *Griseb.*—V., Guilding. Guiana and Brazil.

HYDROPHYLLACEÆ.

Hydrolea spinosa, *L.*—V., Guilding. Widely dispersed in the warmer parts of South America.

BORAGINEÆ.

Cordia Collococca, *L.*—V. 1546, 1836; B. 138; M. 131, 162. Mexico, West Indies, and Columbia.

Cordia cylindrostachya, *Rœm. et Schult.*—V. 470; B. 87; M. 158. West Indies and tropical America.

Cordia dasycephala, *Kunth.* — C. 18; U. 36. Mexico and West Indies to Guiana and Venezuela.

Cordia Gerascanthus, *Jacq.*—V. 1244, 1249. Central America and West Indies to Brazil.

Cordia sulcata, *DC.*—V. 771. West Indies.

Cordia tremula, *Griseb.*—V. 452, 1522; B. 123. Barbadoes.

Cordia ulmifolia, *Juss.*—V. 781, 1813. West Indies and Panama southward to Brazil and Peru.

Bourreria exsucca, *Jacq.*—V., Guilding. New Granada and Venezuela.

Bourreria succulenta, *Jacq.*—V. 551, 569, 846; B. 141; M. 130. West Indies.

Tournefortia bicolor, *Sw.*—V. 110, 337, 434, 1771. Mexico, West Indies and tropical America.

Tournefortia caribæa, *Griseb.*—V. 1540. Dominica and Trinidad.

Tournefortia cymosa, *L.*—V. 876, 1264, 1542. Jamaica and Cuba.

Tournefortia filiflora, *Griseb.*—V. 1260. West Indies.

Tournefortia gnaphalodes, *R. Br.*—V., Guilding; B. 7; M. 26. Florida and West Indies.

Tournefortia hirsutissima, *L.*—V., Guilding. A common plant in Mexico, the West Indies, Central America, and the northern part of South America.

Tournefortia volubilis, *L.*—V. 341, 1277; B. 135; M. 38. West Indies and Venezuela to Brazil.

Heliotropium curassavicum, *L.*—M. 21; U. 34. A common plant from Oregon to Patagonia, chiefly in maritime and saline regions, also in Australia, South Africa, and the Pacific Islands.

Heliotropium fruticosum, *L.*—V. 977; B. 186. Mexico and the West Indies to the northern part of South America.

Heliotropium indicum, *L.*—V. 7, 1213; B. 230, 231; M. 19. A very widely dispersed plant in tropical and sub-tropical countries; but it is supposed to have been introduced into America from the Old World.

Heliotropium parviflorum, *L.*—V. 591, 1582. Widely dispersed in the warmer parts of America.

CONVULVULACEÆ.

Argyreia speciosa, *Choisy*, syn. A. bracteata, *Choisy.*—V. 1611. Introduced from India, and naturalised in Jamaica and Antigua.

Argyreia tiliæfolia, *Wight.*—V. 1610. Introduced from tropical Asia, now common in the West Indies.

Ipomœa acuminata, *Rœm. et Schult.*—V. 1170. Guatemala and West Indies to Brazil.

Ipomœa Batatas, *Lam.*—V. 1167, 1309. The sweet potato is almost universally cultivated in hot countries; and it is also common in a wild state, but its origin is uncertain. It is supposed, however, that the tropical American *I. fastigiata* may be the wild original.

Ipomœa biloba, *Forsk.*, syn. I. pes-capræ, *Sweet.*—V. 490; B. 319. Generally dispersed on the sea-shores of the tropics.

Ipomœa bona-nox, *L.*—V. 1292, 1613; B. 318. Widely diffused in the tropics.

Ipomœa cathartica, *Poir.*—V. 1169. Florida (perhaps introduced) and West Indies to Brazil.

Ipomœa cissoides, *Griseb.*—V. 1158. Mexico and West Indies to Brazil.

Ipomœa coccinea, *L.*—V. 1172. Tropical America, Asia and Africa.

Ipomœa digitata, *L.*—V., Guilding. Generally dispersed in the tropics, chiefly on the sea-shore.

Ipomœa fastigiata, *Sweet.*—V. 116, 612, 1164, 1165, 1166, 1293. West Indies and East tropical America.

Ipomœa filiformis, *Jacq.*—V., Guilding. West Indies.

Ipomœa grandiflora, *Lam.*—V. 1609; B. without number. Cultivated in tropical America. Introduced from the Old World.

Ipomœa hederacea, *Jacq.*—V. 1168, 1290. Common in the warmer parts of America, and now widely dispersed in other countries.

Ipomœa macrorhiza, *Michx.* (*non Rœm. et Schult.*), syn. I. Jalaps, *Pursh.* (*non Nutt.*).—V., Guilding. South Carolina and Mexico to the West Indies.

Ipomœa pentaphylla, *Jacq.*—V. 1157. Generally dispersed in the tropics.

Ipomœa pterodes, *Choisy.*—V. 1159, 1159*a*, 1159*b*. Trinidad, Panama, Venezuela and Guiana.

Ipomœa Quamoclit, *L.*—V. 1171. Generally dispersed in tropical and sub-tropical regions.

Ipomœa repanda, *Jacq.*—V. 1301, 1612. West Indies.

Ipomœa sinuata, *Ort.*, syn. I. dissecta, *Pursh.* (*non Willd*).—V. 250; B. 317. Widely dispersed in the warmer parts of America.

Ipomœa tuba, *Don.*—V., Guilding. West Indies and Guiana.

Ipomœa umbellata, *Mey.*—V. 1160; B. 308, 320. Mexico, West Indies and tropical America.

Ipomœa, four or five undetermined species.—V. 1160*a*, 1161, 1164, 1308, 1920; B. 322, 323.

Jacquemontia tamnifolia, *Griseb.*—V. 310. Southern United States and West Indies to Guiana and Brazil.

Jacquemontia violacea, *Choisy* syn. Convulvulus pentanthus, *Jacq.*—V. 619, 619*a*, 1919; B. 4; M. 47. Florida and Mexico southward to Peru and Brazil.

Convolvulus micranthus, *Rœm.* et *Schult.*—V., Guilding. Mexico and the West Indies to Brazil.

Convolvulus nodiflorus, *Desc.*—V. 1162, 1163. Mexico and the West Indies to Venezuela and Ecuador.

Evolvulus mucronatus, *Sw.*—V., Guilding. C. 30; M. 28. Florida and Mexico southward to Peru and Brazil.

Porana paniculata, *Roxb.*—V. 1654. Introduced from India.

Cuscuta americana, *L.*—V. 390. Mexico and the West Indies to Brazil.

SOLANACEÆ.

Lycopersicum esculentum, *Mill.*—V. 282, 982. Common in Mexico and Central America as well as in other parts of tropical America and the West Indies; but it is difficult to determine where it is really indigenous and where only naturalised.

Solanum bahamense, *L.*—V., Guilding. B. 234; M. 76. Mexico and the West Indies.

Solanum callicarpifolium, *H. B.K.*—V. 294, 294*a*. Mexico and the West Indies to Guiana.

Solanum ciliatum, *Lam.*, syn. S. aculeatissimum, *Griseb.* (*non Jacq.*).—V. 985. Bahamas and Porto Rico, also Brazil.

Solanum hirtum, *Vahl.*—V. 1946. Trinidad.

Solanum igneum, *L.*—V. 698, 1948; B. 232; M. 78, 79. West Indies and Guiana.

Solanum lanceæfolium, *Jacq.*—V. 654. Mexico and West Indies to Venezuela and Brazil.

Solanum mammosum, *L.*—V. 329. U. 26. Mexico and West Indies to Columbia and Guiana.

Solanum neglectum, *Dun.*—V. 511, 1263. Mexico and West Indies.

Solanum nigrum, *L.*, syn. S. nodiflorum, *Jacq.*—V. 95, 450, 639, 1330, 1950; B. 237. A common weed in nearly all tropical and temperate countries; but it is impossible to determine where it is really indigenous.

Solanum racemosum, *L.*—V. 343. West Indies.

Solanum retrofractum, *Vahl.*—B. 180; M. 77. Jamaica.

Solanum seaforthianum, *Andr.*—V., Guilding. West Indies, Panama, Venezuela and Guiana.

Solanum torvum, *Sw.*—V. 252. Widely dispersed in tropical America and Asia.

Solanum triste, *Jacq.*—V. 495, 751, 1772. Mexico and West Indies to Guiana and Peru.

Solanum, two undetermined species.—V. 45, 1575.

Physalis angulata, *L.*—V. 368, 1328, 1329; B. 239. A very widely diffused species in tropical countries.

Physalis minima, *L.*—V. 1947, 1949; B. 238. A widely diffused species in the tropics.

Brachistus macrophyllus, *Miers*, syn. Witheringia macrophylla, *Kunth.*—V. 1252. Mexico and Jamaica to Venezuela and Columbia.

Capsicum frutescens, *L.*—V. 792. Nearly all tropical countries; though probably of American origin.

Acnistus arborescens, *Schlecht.*—V. 242. Mexico and West Indies southward to Peru and Brazil.

Solandra grandiflora, *Sw.*—V. 1298. Mexico and West Indies to Columbia and Brazil.

Datura fastuosa, *L.*—B. 236. Introduced from the Old World.

Datura Stramonium, *L.*—V. 516, 1331. Generally regarded as an Old World species, but it is now common in most tropical and temperate countries.

Datura suaveolens, *Humb. et Bonpl.*—V. 983. Introduced from tropical South America.

Cestrum latifolium, *Lam.*—V. 567. Trinidad.

Cestrum macrophyllum, *Griseb.* (*non Vent.*)—V. 421, 1262, 1773, 1774. West Indies.

Cestrum vespertinum, *L.*—V. 184, 435, 1852. West Indies and Panama southward to Peru and Brazil.

Nicotiana Tabacum, *L.*—V. 1607. A native of South America, now widely dipersed in warm countries.

Browallia demissa, *L.*—V. 1577. West Indies, Central America and Columbia to Guiana and Brazil.

SCROPHULARINEÆ.

Stemodia parviflora, *Ait.*—V. 869. Mexico and West Indies southward to Brazil and Peru.

Vandellia diffusa, *L.*—V. 228. Generally dispersed in tropical America, Africa and Madagascar.

Scoparia dulcis, *L.*—V. 268, 1578; B. 208. A common plant in nearly all tropical and sub-tropical countries.

Capraria biflora, *L.*—V. 303, 1218; B. 209, 210, 211; M. 7; U. 21. Widely dispersed in the warmer parts of America from Florida and Mexico to Brazil and Peru, also in West tropical Africa.

Alectra brasiliensis, *Benth.*—V. 371. Trinidad, Guiana, and South Brazil to New Granada.

LENTIBULARIEÆ.

Utricularia montana, *Jacq.*—V. 130, 467, 1952. West Indies and tropical America.

GESNERACEÆ.

Pentarhaphia longiflora, *Lindl.*—V. 55. West Indies.

Tussacia pulchella, *Reichb.*—V., Guilding. West Indies, Panama and Columbia.

Episcia melittifolia, *Mart.*—V. 27, 519, 629, 1585. West Indies.

Alloplectus cristatus, *Mart.*—V. 147. West Indies and Guiana.

Columnea scandens, *L.*, syn. C. speciosa, *Presl.*—V. 16. West Indies and East tropical America.

Besleria lutea, *L.*—V. 25. West Indies and Venezuela to New Grenada and tropical Brazil.

Besleria, *sp.*—V. 610, 1275, 1276, 1519.

BIGNONIACEÆ.

Bignonia æquinoctialis, *L.*—V. 1553. West Indies and Central America to Brazil.

Bignonia rufinervis, *Hoffmannsegg.*—V., Guilding. Venezuela, Guiana and Brazil.

Bignonia unguis, *L.*—V. 822, 1875; B. 321; M. 40. Mexico and West Indies.

Amphilophium paniculatum, *Kunth.*—V. 899, 939, 1043, 1860. West Indies and tropical America.

Tanæcium crucigerum, *Seem.*—V., Guilding. Dominica.

Tabebuia serratifolia, *Rolfe*, syn. Tecoma serratifolia, *G. Don.*—V. 1652. Trinidad.

Tabebuia, *sp.*—V. 465; B. 69; M. 134.

Tecoma stans, *Juss.*—V. 667; B. 59; M. 133. Southern United States, Mexico and West Indies to Columbia and Peru.

Tecoma spectabilis, *Planch.*—V., Guilding. Trinidad and Venezuela.

Jacaranda obtusifolia, *Humb. et Bonpl.*—V. 1639. Probably naturalised. Native of New Grenada, Guiana and Brazil.

Crescentia cucurbitina, *L.*—V. without number. West Indies and Panama.

Crescentia Cujete, *L.*—V. 917. West Indies and Central America to Peru and Brazil. Generally cultivated in warm countries.

PEDALINEÆ.

Martynia diandra, *Glox.*—V. without number. Mexico, Antigua, and Cuba.

Sesamum indicum, *L.*, syn. S. orientale, *L.*—V. 104, 527. Introduced from India.

ACANTHACEÆ.

Thunbergia alata, *Bojer.*—V. 554. Introduced from Africa.

Thunbergia fragrans, *Roxb.*—V. 40, 757. Introduced from tropical Asia.

Thunbergia grandiflora, *Roxb.*—V. 1307. Introduced from India.

Ruellia tuberosa, *L.*—V. 580, 1602; B. 1; C. 17; M. 18; U. 24. Texas and Mexico southward to Guiana and Peru.

Ruellia fulgida, *Andr.*, syn. Stemonacanthus fulgidus, *Griseb.*—V. 1804. Venezuela and New Grenada.

Ruellia, two species doubtfully referred to this genus.—V. 35, 1199; B. 204.

Blechum Brownei, *Juss.*—V. 35, 583, 1201; B. 215. Mexico and the West Indies southward to Ecuador.

Dædalacanthus nervosus, *T. And.*—V. 1598. Introduced from India.

Barleria lupulina, *Lindl.*—V. 1198. Introduced from Madagascar.

Asystasia coromandeliana, *Nees.*—V. 103. Introduced from the Old World.

Andrographis paniculata, *Nees.*—V. 978; B. 2. Introduced from India.

Lepidagathis alopecuroidea, *R. Br.*—V. 494, 686. Generally diffused in tropical America and the West Indies.

Aphelandra pectinata, *Willd.*—V., Guilding. Mexico and West Indies to Columbia, Guiana, and Peru.

Beloperone sphærosperma, *Benth. et Hook. fil.*, syn. Justicia sphærosperma, *Vahl.*—V. 486, 1200; B. 223. Guiana.

Beloperone violacea, *Planch. et Lind.*, syn. Justicia carthaginensis, *L.*—V., Guilding. Mexico and the West Indies to Columbia and Peru.

Dianthera pectoralis, *Murr.*—V. 1216. Mexico and the West Indies to Brazil.

Dianthera secunda, *Griseb.*—V. 544. West Indies and Panama to Columbia, Peru and Guiana.

Jacobinia coccinea, *Hiern.*, syn. Pachystachys coccinea, *Nees.*—V. 981. West Indies and Guiana to Brazil.

Thyrsacanthus nitidus, *Nees.*—V. 10; B. 46, 47. West Indies.

Dicliptera martinicensis, *Juss.*—V. 1197. Trinidad and Martinique.

MYOPORINEÆ.

Bontia daphnoides, *L.*—V. 1533. West Indies.

VERBENACEÆ.

Lantana Camara, *L.*—V. 587; B. 185. Southern United States, West Indies, and generally dispersed in tropical America.

Lantana crocea, *Jacq.*—V., Guilding. West Indies to Guiana.

Lantana involucrata, *L.*, syn. L. odorata, *L.*—V. 1195; B. 3, 182, 183, 184; M. 87; U. 35. Texas and West Indies to the north part of South America and the Galapagos Islands.

Lantana Radula, *Sw.*—V., Guilding. Dominica, Trinidad and Brazil.

Lantana trifolia, *L.*—V. 377, 1936*a*. West Indies, Central America and tropical South America.

Lippia micromera, *Schauer.*—V., Guilding. West Indies to Guiana.

Lippia nodiflora, *Rich.*—B. 187. In nearly all tropical and sub-tropical countries. One of the very commonest weeds in warm countries.

Lippia reptans, *H.B. et K.*—B. 200; M. 13. West Indies and Mexico to Brazil and Peru.

Stachytarpheta jamaicensis, *Vahl.*—V. 60; B. 224; M. 20. Florida, Mexico and West Indies to Brazil.

Stachytarpheta strigosa, *Vahl.*—V. 218. St. Thomas and Trinidad.

Priva echinata, *Juss.*—V. 714; B. 216; U. 31. Generally diffused in the warmer parts of South America and the West Indies, also Florida.

Petræa volubilis, *Jacq.*—V., Guilding. West Indies and Panama southward to Brazil.

Citharexylum quadrangulare, *Jacq.*—V. 66, 405, 664, 1786; B. 43, 44; M. 140. West Indies and Guiana.

Duranta Plumieri, *Jacq.*—V. 578, 1217. West Indies and Florida southward to Brazil and Peru.

Ægiphila martinicensis, *L.*—V. 336, 753, 1801. West Indies and Guiana.

Tectona grandis, *L. fil.*—V. 1273. Introduced from India.

Cornutia pyramidata, *L.*—V. 613; B. 63. West Indies, Mexico and Central America.

Vitex divaricata, *Sw.*—V. 616, 663, 1536, 1800. West Indies and Guiana.

Clerodendron aculeatum, *Griseb.*—V. 936; B. 79; M. 127. West Indies and Guatemala to Guiana and Brazil.

Clerodendron fragrans, *Willd.*—V. 5. Introduced from China.

Clerodendron Siphonanthus, *R.Br.*—V. 75, 1275, 1600. Introduced from India.

Avicennia nitida, *Jacq.*—V. 546; B. 65. West Indies to Brazil and tropical Africa.

LABIATÆ.

Ocimum Basilicum, *L.*—V. 1214. Introduced from tropical Asia or Africa.

Ocimum micranthum, *Willd.*—V. 523; B. 213; M. 88. West Indies, Florida, Central America and tropical South America.

Coleus acuminatus, *Benth.*—V. 928. Introduced from the Philippines.

Marsypianthes hyptoides, *Mart.*—V. 739, 809, 881. Generally diffused in tropical America and the West Indies.

Hyptis atrorubens, *Poit.*—V. 874. West Indies, Mexico, Guiana, and Brazil, also in Western tropical Africa.

Hyptis brevipes, *Poit.*—V. 617, 1208, 1926. Generally diffused in tropical America and the West Indies, also occurring in tropical Africa and Asia.

Hyptis capitata, *Jacq.*—V. 124, 1320. Generally dispersed in tropical America and the West Indies, also in the Galapagos Islands.

Hyptis pectinata, *Poit.*—V. 431, 1204, 1205, 1206; B. 212. Common and generally dispersed in tropical America and the West Indies, also in tropical and South Africa.

Hyptis spicata, *Poit.*—V. 1204, 1373. Florida, Cuba and Trinidad southward to Buenos Ayres.

Mentha viridis, *L.*—V. 19. Naturalised from Europe.

Salvia coccinea, *L.*—V. 704, 704*a*; B. 222. Southern United States, West Indies and South America.

Salvia lamiifolia, *Jacq.*—V. 807. Trinidad and Cuba.

Salvia occidentalis, *Sw.*—V. 93; B. 217. Florida and the West Indies to the northern part of South America, also in the Galapagos Islands.

Scutellaria purpurascens, *Sw.*—V. 976. West Indies and Mexico southward to Brazil.

Scutellaria Ventenatii, *Hook.*—V. 1274. Dominica and Columbia.

Leonurus sibiricus, *L.*—V. 366; B. 219. Native of Asia, now also widely spread in America and Africa.

Leonotis nepetæfolia, *R.Br.*—V. 13; B. 225. Tropical America, Africa and Asia.

Leucas martinicensis, *R.Br.*—V. 1207; B. 243; U. 19. Tropical America and Africa. Sporadic in India, but doubtfully indigenous.

PLANTAGINEÆ.

Plantago major, L.—V. 914, 1587. In nearly all temperate and warm countries.

NYCTAGINEÆ.

Mirabilis Jalapa, *L.*—V. 432; B. 309. Widely dispersed in tropical America, and cultivated in the warmer regions of the Old World.

Boerhaavia erecta, *L.*—V. 437, 743; B. 192, 194. West Indies and Central America northward to Georgia and New Mexico.

Boerhaavia paniculata, *Rich.*—V. 437*b*. West Indies and Central America northward to Texas and New Mexico, also in the Galapagos Islands.

Boerhaavia viscosa, *Lag. et Rodr.*—V. 437*a*, 979. Widely dispersed in the warmer parts of America.

Boerhaavia, *sp.*—V. 201.

Pisonia aculeata, *L.*—V. 332, 1554, 1557; M. 49. Widely dispersed in the tropics of both hemispheres.

Pisonia inermis, *Jacq.*—V. 484, 1843. West Indies and tropical America.

Pisonia nigricans, *Sw.*—V. 42, 1842; B. 58; M. 151. West Indies.

AMARANTACEÆ.

Amaranthus paniculatus, *L.*—V. 1596. Tropical America. Cultivated throughout India and the warmer regions of Asia.

Amaranthus spinosus, *L.*—V. 111; B. 226. Tropical America. Introduced into tropical Asia and Africa.

Amaranthus tristis, *L.*—V. 2; B. 228, 229; M. 5. Tropical America. Cultivated in tropical Asia.

Amaranthus viridis, *L.*, syn. Euxolus viridis, *Moq.*— B. 227. Dispersed through all warm and tropical countries.

Cyathula prostrata, *Bl.*—V., Guilding. Widely dispersed in tropical America, Africa, India and Polynesia, also in the Canary Islands.

Achyranthes aspera, *L.*—V. 87, 1593; B. 218. Diffused through all warm countries.

Mogiphanes Jacquini, *Schrad.*—V., Guilding. West Indies and East tropical America.

Mogiphanes straminea, *Mart.*—V. 321; B. 289; M. 16. West Indies and Mexico to Brazil.

Telanthera maritima, *Moq.*, syn. Alternanthera ficoidea, *R.Br.*—M. 17. West Indies, Central America, eastern coast of South America, and western coast of Africa.

Telanthera polygonoides, *Moq.*, syn. Alternanthera polygonoides, *R.Br.*—V. 1594. West Indies, Central America and eastern South America.

Telanthera?—V. 882, 1595; B. without number; M. 14.

Alternanthera Achyrantha, *R.Br.*—V. 857. Widely dispersed in the warmer parts of America, also in the Canary Islands and South Europe.

Alternanthera sessilis, *R. Br.*—V. 455. Dispersed through all warm countries.

Philoxerus vermiculatus, *R. Br.*—V. 1033; B. 302; M. 30; U. 39. West Indies, eastern South America and West Africa.

Gomphrena globosa, *L.*—V. 1229. A native of India, now naturalised in most warm countries.

Celosia argentea, *L.*—V. 1223, 1233. Widely diffused in tropical Asia, Africa and America.

Iresine celosioides, *L.*—V. 199, 574. South Carolina and Florida to Peru and Bolivia.

CHENOPODIACEÆ.

Chenopodium ambrosioides, *L.*—V. 980, 980*a*. Common in America, as well as in the Old World, and uncertain where it is really indigenous.

PHYTOLACCACEÆ.

Rivina lævis, *L.*—V. 320, 1319; B. 181; C. 15. West Indies and the warmer parts of America.

Villamilla octandra, *Hook. f.*, syn. Rivina octandra, *L.*—V. 549, 1614; B. 129; M. 35. West Indies, Central and tropical America.

Petiveria alliacea, *L.*—V. 689; B. 220. From Florida and Mexico to South Brazil.

Microtea debilis, *Sw.*—V. 178, 1584. West Indies, Central America and tropical South America.

Phytolacca icosandra, *L.*—V. 423. From the West Indies and South Mexico to Peru and Brazil.

POLYGONACEÆ.

Polygonum acre, *H. B.K.*—V. 1591. Widely dispersed in America, from Canada to Buenos Ayres.

Coccoloba excelsa, *Benth.* ?—V. 1259, 1529. Guiana.

Coccoloba uvifera, *Jacq.*—V. 509; B. 128; M. 155. West Indies, Central America and tropical South America.

Coccoloba, *sp.*—V. 1790; B. 40, 136.

ARISTOLOCHIACEÆ.

Aristolchia obtusata, *Sw.*—V., Guilding. Guadeloupe.

Aristolochia trilobata, *L.*—V. 333, 333a. West Indies, Panama, Guiana and Brazil.

PIPERACEÆ.

Piper aduncum, *L.*, syn. Artanthe adunca, *Miq.*—V., Guilding. West Indies and tropical America.

Piper æquale, *Vahl.*, syn. Artanthe æqualis, *Miq.*—V. 193, 1326. West Indies and Brazil.

Piper Betle, *Miq.*—V. 1641. Introduced from tropical Asia.

Piper confusum, *C. DC.*—V. 916. Cuba and San Domingo.

Piper dilatatum, *Rich.*, syn. Artanthe Bredemeyeri, *Miq.*—V. 30, 125; B. 245, 246. West Indies, Central America and tropical South America.

Piper hirsutum, *Sw.*, syn. Artanthe scabra var. hirsuta, *Griseb.*—V. 33, 48, 828, 1325, 1921. West Indies and Central America to Peru and Brazil.

Piper nigrum, *L.*—V. 1324. Cultivated in most tropical countries. Native of tropical Asia.

Piper peltatum, *L.*, syn. Pothomorphe peltata, *Miq.*—V. 190. West Indies, Central America and the northern part of South America.

Piper Sieberi, *C. DC.*, syn. Enckea Sieberi, *Miq.*—V. 219, 1922. West Indies, Venezuela and Argentina.

Piper tuberculatum, *Jacq.*, syn. Artanthet uberculata, *Miq.*—V., Guilding. West Indies and tropical America.

Piper, *sp.*—V. 1923.

Peperomia alpina, *A. Dietr.* ?—V. 1643. Jamaica and Cuba.

Peperomia cuneata, *Miq.*, syn. Peperomia obtusifolia var. cuneata, *Griseb.*—V. 1322. Not known from elsewhere.

Peperomia exilis, *Griseb.*—V. 1647. West Indies.

Peperomia hernandiæfolia, *A. Dietr.*—V. 920. West Indies.

Peperomia magnoliæfolia, *A. Dietr.*, syn. P. amplexicaulis var. magnolifolia, *Griseb.*—V. 23, 1642. West Indies, Central America and the northern part of South America.

Peperomia nemorosa, *Vahl.* — V. 1645, 1646. West Indies and Guiana.

Peperomia nummulariæfolia, *H. B.K.*—V. 257. West Indies and South Mexico to Peru and Brazil.

Peperomia obtusifolia, *A. Dietr.*—V., Guilding. West Indies and tropical America.

Peperomia ovalifolia, *Hook.*, syn. P. trifolia, *A. Dietr.*—V. 871, 871*a*, 995. West Indies.

Peperomia pellucida, *H. B.K.*—V. 594. West Indies and Central America to Peru and Brazil, also in tropical Africa.

Peperomia Rupertiana, *C.DC.* ? — V. 1321, 1644; B. 244. Dominica.

Peperomia scandens, *Ruiz et Pav.*, syn. P. repens, *H. B.K.*—V. 1323. West Indies and Central America to Peru and Brazil.

Peperomia trifolia, *A. Dietr.*—V., Guilding. Dominica, Guadeloupe and St. Lucia.

Peperomia vincentiana, *Miq.*—V., 921. Not known from elsewhere.

Peperomia, *sp.*—V. 1925.

CHLORANTHACEÆ.

Hedyosmum arborescens, *Sw.*—V. 251, 1256. West Indies.

MYRISTICEÆ.

Myristica fragrans, *Houtt.*—V. 1280. Native of the eastern Moluccas; naturalised in some of the West Indian islands.

Myristica surinamensis, *Roland.*—V., Guilding. Trinidad and East tropical America.

Myristica, *sp.*—V. 1520.

MONIMIACEÆ.

Siparuna glabrescens, *A. DC.*, syn. Citrosma glabrescens, *Presl.*—V. 24, 433, 915. West Indies.

LAURINEÆ.

Aniba bracteata, *Mez.*, syn. Aydendron argenteum, *Griseb.*—V. 687, 1839. From Porto Rico and Montserrat to St. Vincent.

Endlicheria sericea, *Nees.*, syn. Aydendron sericeum, *Griseb.*—V. 240, 323, 353, 1840. West Indies and East tropical America.

Cinnamomum zeylanicum, *Bl.*—V. 1572. Native of the East Indies, now cultivated or naturalised in many parts of the tropics.

Persea gratissima, *Gærtn.*—V. 275, 1571. West Indies and tropical America.

Ocotea Sieberi, *Hemsl.*, syn. Oreodaphne cernua, *Nees.*—V. 512. Central America and West Indies.

Ocotea martinicensis, *Mez.*—V. 428, 428*a*. Jamaica and Montserrat to Martinique.

Ocotea, *sp.* ?—V. 1567.

Nectandra membranacea, *Griseb.*—V. 1272. West Indies.

Nectandra patens, *Griseb.*—V. 636, 681, 733, 1543. West Indies.

Nectandra willdenoviana, *Nees.*, syn. N. coriacea, *Griseb.*—V. 1569; B. 51, 52. Florida and West Indies.

Cassytha americana, *Nees.*—V. 1918; M. 46. Tropics of America, Africa, Asia and Australia.

Hernandia sonora, *Linn.*—V. 1651. West Indies and Pacific Islands.

THYMELÆACEÆ.

Daphnopsis caribæa, *Griseb.*—V. 927, 1284. West Indies.

LORANTHACEÆ.

Loranthus emarginatus, *Sw.*—V., Guilding. Jamaica and Antigua.

Loranthus uniflorus, *Jacq.*—V. 1282, 1624, 1625, 1626. West Indies.

Dendrophthora myrtilloides, *Eichl.* syn. Phoradendron myrtilloides, *Griseb.*—V. 1306, 1925; B. 307; M. 34. West Indies, Brazil and Venezuela.

Phoradendron Berterianum, *Griseb.*—V. 297. West Indies and Venezuela.

Phoradendron flavens, *Griseb.*—V. 374. Mexico and West Indies to Brazil.

Phoradendron hexastichum, *Griseb.*—V., Guilding. Mexico and Cuba.

Phoradendron latifolium, *Griseb.*—V. 245, 245*a*, 248, 1305. Central America, West Indies and Brazil.

Phoradendron rubrum, *Griseb.*—V. 1623. North Mexico and West Indies to Brazil and Peru.

EUPHORBIACEÆ.

Pedilanthus tithymaloides, *Poit.*—V. 340; B. 122. West Indies and Venezuela.

Euphorbia buxifolia, *Lam.*—V. 553, 1941; B. 105, 199; M. 22, 23; U. 27. Florida, British Honduras, West Indies and Venezuela.

Euphorbia geniculata, *Ort.*, syn. E. heterophylla var. prunifolia, *Griseb.*—V. 744. Texas and West Indies to Brazil and Peru.

Euphorbia hypericifolia, *L.*—V. 106; B. 198; M. 12. Widely dispersed in the warmer parts of America.

Euphorbia linearis, *Retz.*, syn. E. articulata, *Burm.*—V. 208, 1940. West Indies.

Euphorbia nudiflora, *Jacq.*—V., Guilding. Mexico and West Indies.

Euphorbia pilulifera, *L.*—V. 154; B. 197; M. 12*a*. Widely dispersed in the warmer regions of both hemispheres.

Euphorbia prostata, *Ait.*—B. 202; M. 32. Widely dispersed in the warmer parts of America; also in tropical Africa, Bourbon and Mauritius.

Euphorbia thymifolia, *Burm.*, syn. E. maculata var. thymifolia, *L.*—V. 335, 673, 1937. Throughout the tropics.

Phyllanthus Conami, *Sw.*—V., Guilding. West Indies and tropical America.

Phyllanthus distichus, *Muell. Arg.*, syn. Cicca disticha, *L.*—V. 1556. Introduced from the East Indies and naturalised in some of the West Indian Islands.

Phyllanthus falcatus, *Sw.*—V., Guilding. Jamaica, Bahamas and Barbadoes.

Phyllanthus Niruri, *L.*—V. 656. Throughout the tropics.

Phyllanthus nobilis, *Muell. Arg.*, syn. Cicca antillana, *Juss.*—V. 475, 675, 1555 ; M. 128. West Indies and tropical America.

Phyllanthus reticulatus, *Poir.*—V. 522, 872, 872*a*. Tropical Asia and Africa.

Drypetes glauca, *Vahl.*—V. 1810. West Indies.

Hieronyma alchorneoides, *Allem.*—V. 214. Trinidad, Panama and Brazil.

Hevea guianensis, *Aubl.*, syn. Siphonia elastica, *Pers.*—V., Guilding. Introduced from Guiana.

Jatropha Curcas, *L.*—V. 671; B. without number; M. 135. Tropics of both hemispheres.

Jatropha gossypifolia, *L.*—V. 67; B. 101, 103; M. 11. West Indies and tropical America.

Jatropha multifida, *L.*—V., Guilding. St. Kitts, Venezuela and Guiana, also naturalised in Jamaica.

Jatropha urens, *L.*—V. 164; B. 102; M. 10. Central America, West Indies, Venezuela, Guiana and Brazil.

Aleurites triloba, *Forst.*—V. without number. Native of the Pacific Islands, but naturalised in India, Malaya and the West Indies.

Croton flavens, *L.*—V. 206, 1819; B. 94, 95; C. 9; M. 138; U. 16. West Indies.

Croton Guildingii, *Griseb.*—V. 457, 1251, 1512, 1814, 1815, 1816*a*, 1817, 1818, 1955 ; B. 91 ; M. 136. Not known from elsewhere.

Croton helicoideus, *Muell. Arg.*, syn. C. niveus, *Griseb.* (*non Jacq.*). — B. 93. Venezuela.

Croton lobatus, *L.*—V. 703. Mexico and West Indies to Brazil and Ecuador.

Croton niveus, *Jacq.*—V. 1258; B. 92; M. 137. Central America, West Indies and the northern parts of South America.

Croton populifolius, *Sw.*—V. 28, 561, 783, 784, 1250; B. 88, 89, 90 ; M. 139. West Indies, Panama, Venezuela and Colombia.

Croton pseudochina, *Schlecht.*—V., Guilding. Trinidad and tropical America.

Argithamnia lancifolia, *Muell. Arg.*, syn. Ditaxis glabella, *Griseb.*—V. 1255, 1581, 1937 ; B. 207. West Indies and Colombia.

Bernardia corensis, *Muell. Arg.*, syn. Polybœa corensis, *Kl.*—V. 560 ; B. 196. West Indies.

Bernardia carpinifolia, *Griseb.*—V. 1257. Jamaica, San Domingo and Cuba.

Acalypha cuspidata, *Jacq.*—V. 878, 1514; B. 96. Mexico and West Indies to Peru and Brazil.

Acalypha hernandifolia, *Sw.* —V. 246. West Indies.

Ricinus communis, *L.*— V. 448 ; B. 98. Widely dispersed through the tropics.

Plukenetia volubilis, *L.*—V. 422, 1291. Dominica and Martinique.

Tragia volubilis, *L.*—V. 563, 737, 1885 ; B. 173; M. 44 ; U. 32. Central America, West Indies and the northern part of South America.

Dalechampia scandens, *L.*—V. 1156. Central America, West Indies, Venezuela and Guiana.

Omphalea diandra, *L.*—V. 1655. West Indies, and East tropical America.

Hippomane Mancinella, *L.*—V. 934; B. 142; M. 125. Florida, Central America, West Indies and the western coast of tropical South America.

Sapium aucuparium, *Jacq.*—V. 492, 1265. West Indies, Venezuela and Guiana.

Sebastiana corniculata, *Muell. Arg.*, syn. Microstachys corniculata, *Juss.*—V. 605. Trinidad and tropical South America.

Hura crepitans, *L.*—V. 804; B. 114. West Indies and tropical America.

URTICACEÆ.

Celtis aculeata, *Sw.*—B. 73, 74, 107. West Indies, South Mexico, Panama, Venezuela and Colombia to Peru.

Trema lamarckiana, *Bl.* syn. Sponia Lamarckiana, *Dcne.*—V. 6. Bahamas, Jamaica and Dominica.

Trema micrantha, *Bl.*, syn. Sponia micrantha, *Dcne.*—V. 70, 443. West Indies, tropical America.

Dorstenia Contrayerva, *L.*—V. 476. West Indies and South Mexico to Venezuela and Peru.

Ficus pallida, *Vahl.*—V. without number. Jamaica, Dominica and Columbia.

Ficus populnea, *Willd.*—V. 447, 924; B. 54, 55; M. 122. West Indies.

Ficus, two or three undetermined species.—V. 747, 913, 1408, 1560, 1732.

Brosimum Alicastrum, *Sw.*—V. 1755. Central America and Jamaica.

Artocarpus incisa, *L.*—V. 1412. Native of the Pacific Islands, now cultivated or naturalised in various parts of the tropics.

Artocarpus integrifolia, *L.*—V. 812. A native of India, now widely cultivated in the tropics.

Cecropia palmata, *Willd.*?—V. 1407. West Indies, Guiana and Brazil.

Cecropia peltata, *L.*—V. 211; B. 100. West Indies and Venezuela.

Fleurya æstuans, *Gaud.*—V. 41, 41*a*; B. 174. Widely dispersed in tropical America, tropical Africa and the Mascarene Islands.

Urera baccifera, *Gaud.*—V. 1194. West Indies and Panama to Brazil.

Urera caracasana, *Gaud.*—V. 713, 1604. Widely dispersed in the warmer parts of America.

Pilea ciliaris, *Wedd.*—V. 26, 150, 215. West Indies and Venezuela.

Pilea diffusa, *Wedd.*—V. 1603. Jamaica.

Pilea microphylla, *Liebm.*—V. 311, 873, 873*a*, 1938; B. 201; M. 31. West Indies and tropical America.

Pilea ovalis, *Griseb.*—V. 805. Trinidad.

Pilea pubescens, *Liebm.*—V. 56. Widely dispersed through tropical America.

Bœhmeria ramiflora, *Jacq.*—V. 57. West Indies.

MYRICACEÆ.

Myrica, *sp.*—V. 1279.

ORCHIDEÆ.

Pleurothallis floribunda, *Lindl.*—V. 680. Martinique.

Pleurothallis ruscifolia, *R.Br.*—V. 414. Widely diffused in the West Indies, from Cuba and Jamaica to Trinidad; also Guiana. Lindley unites with this the Peruvian *P. succosa*, Lindl., syn. *P. multicaulis*, Pöpp. & Endl., which seems distinct.

Stelis scabrida, *Lindl.*—V. 90, 1661. Dominica. The St. Vincent piece referred by Grisebach to *S. ophioglossoides*, Sw., apparently belongs to *S. scabrida*, Lindl.

Lepanthes ?—V. 1142, 1154. Two undetermined species, of which the genus is somewhat doubtful, owing to incomplete materials.

Octomeria graminifolia, *R.Br.*—V. 454. Dominica and Grenada, and Grisebach records it from Guadeloupe.

Microstylis umbellulata, *Lindl.*—V. 1144. West Indies and tropical America.

Elleanthus lepidus, *Rchb. f.*—V. 1414. Grenada and East tropical America.

Elleanthus, *sp.*—V. 1414*a*.

Isochilus linearis, *R. Br.*—V. 471. West Indies and tropical America.

Epidendrum ciliare, *L.*—V. 117; B. 303. West Indies and tropical America.

Epidendrum elongatum, *Jacq.*—V. 298. West Indies and tropical America.

Epidendrum fuscatum, *Sw.*—V. 32, 623, 1149. West Indies and tropical America.

Epidendrum globosum, *Sw.*—V. 313. West Indies and Guiana.

Epidendrum nocturnum, *L.*—V. 1141. West Indies and tropical America.

Epidendrum pallidiflorum, *Hook.*—V. 1668. Dominica.

Epidendrum ramosum, *Jacq.*—V. 1147. West Indies and tropical America.

Epidendrum rigidum, *Jacq.*—V. 883, 1148. West Indies and tropical America.

Epidendrum strobiliferum, *Rchb. f.*—V. 1145. West Indies and tropical America.

Epidendrum umbellatum, *Sw.*—V. 1009, 1150. West Indies and tropical America.

Epidendrum vincentinum, *Lindl.*—V., Guilding. Not known from elsewhere.

Epidendrum, *sp.*—V. 1153, 1667.

Brassavola cucullata, *R.Br.*—V. 638, B. without number; M. 69; U. 13. West Indies and tropical America.

Polystachya luteola, *Hook.*—V. 289, 450, 900. West Indies and tropical America.

Cyrtopodium Andersonii, *R.Br.*—V. (Grisebach). Trinidad and East tropical America.

Cyrtopera Woodfordii, *Lindl.*—V. 401. West Indies and tropical America.

Xylobium pallidiflorum, *Rolfe*, syn. Maxillaria pallidiflora, *Hook.*—V. 1422. Dominica and Grenada.

Dichæa graminoides, *Lindl.*, syn. D. graminea, *Griseb.*—V., Guilding. West Indies and tropical America.

Dichæa muricata, *Lindl.*—V. 1011. West Indies and tropical America.

Ornithidium coccineum, *Salisb.*—V. 1146, 1151. Dominica, Martinique and Grenada, and Grisebach records it from Jamaica.

Rodriguezia secunda, *H. B.K.* — V., Guilding. Trinidad and tropical America.

Oncidium altissimum, *Sw.*—V. 244. Porto Rico, Dominica and Martinique.

Oncidium luridum, *Lindl.*—V. 685. West Indies, Mexico and Venezuela.

Leochilus cochlearis, *Lindl.*—V. 1662. Jamaica, Cuba and Trinidad.

Ionopsis utricularioides, *Lindl.*—V. 749, 794. West Indies and tropical America.

Ionopsis, *sp.*—V. 1666. Indeterminable.

Vanilla phæantha, *Rchb. f.*—V. 1336. Cuba and San Domingo. The St. Vincent specimen cited by Grisebach under *V. planifolia*, Andr., belongs here.

Cranichis muscosa, *Sw.*—V. 1144, 1665. Jamaica, Cuba, Dominica, Martinique, Grenada and Trinidad.

Prescottia stachyoides, *Lindl.*—V. 949. West Indies and tropical America.

Ponthieva petiolata, *Lindl.*—V. 949, 1952. Jamaica, Cuba, Dominica, Martinique, St. Lucia and Grenada.

Spiranthes orchioides, *Hemsl.* syn. Stenorrhynchus orchioides, *Rich.* —V. 306. West Indies and tropical America.

Pelexia spiranthoides, *Lindl.*—V. McRae. Jamaica, Cuba, and San Domingo.

Physurus hirtellus, *Lindl.*—V. 1372, 1664. Jamaica, Cuba, Dominica, Martinique, St. Lucia and Grenada.

Physurus plantagineus, *Lindl.*—V. 1663. Jamaica, Cuba, Dominica, Martinique, Grenada and Trinidad.

Pogonia macrophylla, *Lindl.*—V. 1924, 1951. Jamaica, Cuba and Dominica.

Chloræa Ulantha, *Rolfe*, syn. Ulantha grandiflora, *Hook. Bot. Mag.*, sub t. 2990; *Griseb. Fl. Brit. W. Indies*, p. 633; Neottia? grandiflora, *Hook. Bot. Mag.*, t. 2956.—V., Guilding. It is strange that nothing more should be known about this remarkable plant than is contained in the original description. Grisebach says it is probably not indigenous in St. Vincent, and Bentham and Hooker (Gen. Pl. iii., p. 618) cite Lindley as the authority for its being a *Chloræa*, and for its not being a native of the West Indies.

Habenaria alata, *Hook.*—V. 1155. Jamaica and Cuba, and Grisebach records it from Antigua.

Habenaria maculosa, *Lindl.*—V. 1143. W. Indies and tropical America.

SCITAMINEÆ.

Hedychium coronarium. *L.*—V. 728. Introduced from tropical Asia.

Zingiber officinale, *Rosc.*—V. 1963. Cultivated throughout the tropics; native country uncertain, though probably tropical Asia.

Costus cylindricus, *Jacq.*—V., Guilding. Martinique, Trinidad and Guiana.

Costus spicatus, *Sw.*—V. 328. West Indies.

Costus spiralis, *Rosc.*—V., Guilding. Trinidad and Brazil.

Alpinia nutans, *Rosc.*—V. 797, 1964. Naturalised in the West Indies. Native of tropical Asia.

Renealmia caribæa, *Griseb.*—V. 15, 817. Dominica and Martinique.

Renealmia occidentalis, *Griseb.*—V., Guilding. West Indies, Panama and New Granada.

Renealmia, *sp.*—V. 1965.

Ischnosiphon Arouma, *Korn.*—V. 267. West Indies, Guiana, Brazil.

Maranta arundinacea, *L.*—V. 189. West Indies and tropical America.

Maranta indica, *Tuss.*—V., Guilding. West Indies and tropical America.

Calathea Allouya, *Lindl.*—V., Guilding. West Indies and Guiana.

Calathea myrosma, *Lindl.*—V., Guilding. West Indies and Guiana.

Canna coccinea, *Ait.*—V., Guilding. West Indies and Guiana.

Canna glauca, *L.*—V. 1. West Indies, Mexico and tropical South America.

Heliconia Bihai, *Sw.*—V. 1410, 1699, 1699*a*, 1962, 1962*a*. West Indies, Mexico, Guiana and Western tropical South America.

Heliconia hirsuta, *L. fil.*—V., Guilding. Tropical America.

BROMELIACEÆ.

Bromelia Pinguin, *L.*—V. 1684. West Indies and tropical America.

Karatas Plumieri, *E.Morr.*—V. 1685. West Indies and Panama to Guiana.

Æchmea bracteata, *Griseb.*—V. 646, 1425, 1426. West Indies.

Æchmea odora, *Baker*.—V. 481; B. 305. West Indies, French Guiana and Brazil.

Pitcairnia alta, *Hassk*.—V. 1430, 1681. B. without number. West Indies.

Pitcairnia bracteata, *Ait*.—V. 624, 826, 1432. West Indies.

Caraguata lingulata, *Lindl*.—V. 1683. West Indies, Guiana, Columbia and Ecuador.

Tillandsia compressa, *Bertero*.—V. 1680. Jamaica.

Tillandsia fasciculata, *Sw*.—V., Guilding. Florida, Mexico and West Indies.

Tillandsia martinicensis, *Baker*.—V. 1428. Martinique.

Tillandsia megastachya, *Baker*, syn. T. foliosa, *Griseb*.—V. 1427. 1682 is perhaps the fruit of this species. Not hitherto collected elsewhere.

Tillandsia polystachya, *L*.—V. 1424, 1686. West Indies, South Mexico and Columbia.

Tillandsia utriculata, *L*.—V. 1431; B. 304. Florida, West Indies, Venezuela and Guiana.

Tillandsia (Vriesia) *sp*.—V. 504.

Catopsis nitida, *Baker*, syn. C. nutans, *Griseb*.—V. 774. Florida, West Indies and British Guiana.

HÆMODORACEÆ.

Xiphidium floribundum, *Sw*.—V. 1423. Mexico and West Indies to Brazil.

Sansevieria guineensis, *Willd*.—V. 1706. Introduced from tropical Africa.

IRIDEÆ.

Trimezia martinicensis, *Herb*., syn. Cipura martinicensis, *H. B. K.*—V. 637. West Indies and Mexico to South Brazil.

Cipura plicata, *Griseb*.—V. 715. West Indies.

AMARYLLIDEÆ.

Hypoxis decumbens, *L*.—V. 14. From Mexico and West Indies to Peru and Buenos Ayres.

Curculigo scorzoneræfolia, *Baker*, syn. Hypoxis scorzonerifolia, *Lam*.—V., Guilding. West Indies and tropical America.

Zephyranthes tubispatha, *Herb*., syn. Amaryllis tubispatha, *Ker*.—V. 1702. West Indies, Venezuela and New Grenada.

Hippeastrum equestre, *Herb*., syn. Amaryllis equestris, *Ait*.—V. 1701. From Mexico and West Indies to Chili and Brazil.

Hymenocallis caribæa, *Herb*.—V. 385; B. 306. West Indies.

Agave caribæa, *Baker*?—V. 1704, 1705.

Agave rigida, *Mill*. var.—V., J. H. Hart. A short-leaved form, known only from St. Vincent.

Furcræa gigantea, *Vent*. var. **willemetiana**, Roem.—V., Powell, West Indies.

Furcræa cubensis, *Haw*.—B. without number. West Indies, tropical America.

DIOSÇOREACEÆ.

Dioscorea alata, *L.*—V. 1886, 1888. West Indies, said to be introduced. Tropical India, tropical Africa, Fiji and Samoa.

Dioscorea cayennensis, *Lam.*—V. 116. West Indies, Panama, Guiana and Brazil.

Dioscorea multiflora, *Presl.*—V. 230, 426, 1313. West Indies and Brazil.

Dioscorea pilosiuscula, *Berter.*—V. 620. West Indies.

Dioscorea trifida, *L.*—V. 120. Jamaica, Guiana and Brazil.

LILIACEÆ.

Smilax solanifolia, *A.DC.*—V. 923, 1880. St. Lucia and Trinidad.

Smilax, two or three undetermined species.—V. 233, 312, 1615, 1878, 1879.

Aloe vera, *L.*, syn. Aloe vulgaris, *Lam.*—V. 1707. Native of the Mediterranean region, but now introduced into many of the warm regions of the world.

COMMELINACEÆ.

Commelina nudiflora, *L.*—V. 22, 759. Common in the hot moist regions of the whole world.

Commelina virginica, *L.*—V. 1953; B. 171; M. 50; U. 22. Spread from Texas and Cuba to Paraguay.

Cyanotis cristata, *Rœm. et Sch.*—V. 760. Introduced from the Old World.

Tradescantia elongata, *Mey.*—V., Guilding. West Indies and tropical America.

Tradescantia geniculata, *Jacq.*—V. 456, 700, 1369, 1660. Widely diffused through the West Indies, and extending from Mexico to Paraguay; also in the Sandwich Islands.

Callisia repens, *L.*—V. 1659. West Indies and Mexico to Brazil and Peru.

Rhœo discolor, *Hance*, syn. Tradescantia discolor, *L'Herit.*—V. 1703; B. 14. Guadeloupe, Cuba, St. Thomas, Mexico; introduced into Jamaica.

PALMÆ.

Areca Catechu, *L.*—V. 1711, 1969. Fruit only. Extensively cultivated in India and Malaya, in some part of which it is probably indigenous.

Oreodoxa oleracea, *Mart ?*—V. 1710. West Indies.

Chamædorea, *sp.*—V. 1712. The leaves of V. 1711 also belong to this genus.

Geonoma Brongniartii, *Mart.*—V. 1433. Martinique, Trinidad, Bolivia.

Caryota urens, *L.*—V. 1714. Introduced. Tropical Asia.

Bactris major, *Jacq.*—V. 1709. New Grenada.

Desmoncus polyacanthus, *Mart.*—V. 1713. Tobago, Trinidad, Guiana, Brazil.

Acrocomia, *sp.*—V. without number.

Martinezia erosa, *Linden.*—V. 239. West Indies.

Cocos, *sp. ?*—V. 1969. Leaves only.

The seed of a small palm, believed to be a species of **Prestoea**, growing on the slopes of the St. Vincent Soufrière, was brought to Kew by Mr. Morris in May 1886. No specimens of this appear to have been received from Messrs. Smith. It is very desirable to obtain adequate herbarium material in order to determine this interesting plant.

CYCLANTHACEÆ.

Carludovica Plumieri, *Kunth.*—V. 149, 691, 1413. Dominica, Trinidad and Tobago.

AROIDEÆ.

Pistia stratiotes, *L.*—V. 224. Tropics of the whole world.

Caladium bicolor, *Vent.*—V. 1690. West Indies, Guiana and Brazil.

Caladium hæmatostigma, *Kunth.*—V. 799, 1957. Brazil.

Caladium marginatum, *C. Koch ?*—V. 1691.

Caladium purdieanum, *Schott.*—V. 1415. Brazil and Peru.

Xanthosoma hastifolium, *Schott.*—V. 1421. Brazil.—V. 1961 is perhaps a variety of this species.

Xanthosoma helleborifolium, *Schott.*—V. 1419. West Indies, Central and tropical South America.

Xanthosoma, two or three undetermined species.—V. 1420, 1692, 1693, 1694, 1695, 1696, 1697, 1958, 1959, 1960.

Philodendron hederaceum, *Schott ?*—V. 1688. West Indies and tropical America.

Philodendron, *spp.*—V. 263, 1687.

Montrichardia, *sp.*—V. 1689.

Dieffenbachia Seguine, *Schott.*—V. 1411. West Indies, Venezuela, Guiana and Brazil.

Monstera Adansonii, *Schott.* Monstera pertusa, *Griseb.*—V. 37. West Indies and tropical South America.

Anthurium Guildingii, *Schott*, syn. Anthurium concinnum, *Schott.*—V. 868, 1416, 1417, 1418, 1698, 1698*a*. Guadeloupe and Martinique.

Anthurium Huegelii, *Schott.*—V. 1954. Guadeloupe, Dominica and Jamaica.

CYPERACEÆ.

Kyllinga odorata, *Vahl.*, syn. Kyllinga triceps, *Griseb.*—V. 1083. America, from Florida to Argentina, common.

Kyllinga brevifolia, *Rottb.*, syn. Kyllinga monocephala, *Griseb.* (*non Rottb.*).—V. 212. World, except north cool regions, abundant.

Kyllinga pumila, *Michx.* V. 408. America, from North United States to South Brazil, common; also tropical Africa.

Pycreus polystachyus, *Beauv.*, syn. Cyperus polystachyus, *Rottb.*—V. 879; also var. **hahniana**, *C. B. Clarke*, syn. Cyperus hahnianus, *Bœckl. in Flora*, LVI., p. 138. B. 347. World, in warm regions, especially near the sea, common.. The variety was only previously known from Martinique (*Sieber, Agrostotheca, n.* 145).

Cyperus elegans, *L.* (*non Kunth*), syn. C. viscosus, *Aiton.*—V. 1088, 1091; B. 341. West Indies, abundant, also Florida and Galapagos Islands.

Cyperus compressus, *L.*—C. 22. World, in warm regions; in America from Virginia to South Brazil, common.

Cyperus diffusus, *Vahl.*, syn. C. elegans, *Swartz*, C. laxus, *Griseb.*—V. 1090, 1675, 1970. World, in tropical regions, common.

Cyperus distans, *L. f.*—V. 1677. World, in tropical and subtropical regions; in America from Cuba to Rio Janeiro, common.

Cyperus rotundus, *L.*—B. 338; M. 53. World, in warm regions; a noxious weed.

Cyperus sphacelatus, *Rottb.*—V. 520, 842. America and Africa, in warm regions; in the former from California to South Brazil, very plentiful in the West Indies.

Mariscus ferax, *C. B. Clarke*, syn. Cyperus ferax, *Rich.*, C. odoratus, *Griseb.* (*non L.*), and C. flexuosus, *Vahl.*—V. 351, 722. World, in warm regions; very plentiful in America from New Orleans to Argentina.

Mariscus flavus, *Vahl.*, syn. Cyperus flavamariscus, *Griseb.* partim.—V. 1084. America, Texas to Argentina, common.

Mariscus rufus, *H. B.K.*, syn. Cyperus ligularis, *L.*—V. 346; B. 337; M. 54. America, Virginia to South Brazil, plentiful in West Indies, Africa, and Mascarene Islands.

Mariscus Jacquinii, *H. B.K.*—V. 243. Central America and Venezuela. Received from no other West Indian Island except St. Vincent.

Mariscus purpurascens, *C. B. Clarke*, syn. Cyperus brunneus, *Griseb.* partim.—V. 381. West Indies, Martinique, Guadeloupe, Dominica and Trinidad.

Eleocharis interstincta, *R. Br.* syn. Scirpus plantagineus, *Griseb.* (*non L.*).—V. 11. Tropical and sub-tropical America, general.

Fimbristylis complanata, *Link*, syn. Scirpus amentaceus, *Griseb.*—V. Guilding. World, in warm regions, general.

Fimbristylis ferruginea, *Vahl.* syn. Scirpus ferrugineus, *L.*—V. 41; M. 52. World, in warm regions, especially near the sea, very common.

Fimbristylis diphylla, *Vahl.* syn. Scirpus brizoides, *Sm.*—V. 115, 1086, 1972; B. 339. World except Arctic and cold regions, universal and abundant.

Fimbristylis monostachya, *Hassk.* syn. Abildgaardia monostachya, *Vahl.*—V. 850; B. 342; C. 21; M. 51. World, in warm regions, general.

Fuirena umbellata, *Rottb.*—V. 929. World, in warm regions, general.

Dichromena radicans, *Cham. et Schlecht.*—V. 237. West Indies and Central America, very common.

Dichromena ciliata, *Vahl.*, syn. Rynchospora pura and R. vahliana, *Griseb.*—V. 539; B. 346. Tropical America, from Mexico to Uruguay, plentiful in West Indies.

Rynchospora polyphylla, *Kunth.*—V. 133. Central America. West Indies, common, Venezuela and New Grenada.

Rynchospora tenuis, *Link.*, syn. R. cubensis, *Griseb.*—V. 843, America, from Mexico to Uruguay.

Rynchospora micrantha, *Vahl.*—V. 779, 1085. West Indies, common; Central America, Brazil, and tropical West Africa.

Rynchospora longiflora, *Presl.*, syn. R. florida *Griseb.* partim.—V. 1089, 1676. West Indies, Martinique, Dominica and Guadeloupe.

Cladium restioides, *Benth.*, syn. Machaerina restioides, *Vahl.*—V. 134. West Indies, common.

Scleria latifolia, *Sw.*—V. 694, 708, 741, 758. West Indies, frequent, also Guatemala and Venezuela.

Scleria arundinacea, *Kunth.*, syn. S. latifolia, var. β et γ, *Griseb.* —V. 741*a*, 1971. West Indies and tropical South America.

Scleria pratensis, *Nees.*—V. 88, 707; B. 343, 353. Common in the warmer parts of America, from Mexico and the West Indies to Paraguay.

Scleria lithosperma, *Sw.*—V. 1087; B. 340. World, in tropical and sub-tropical regions, common.

Scleria reflexa, *H. B.K.*, syn. S. flagellum, *Berg.*—V. 262. West Indies and Central America.

Scleria mitis, *Berg.*—V. 1674. Tropical America, common; from Panama to South Brazil. In the West Indies, received only from St. Vincent and Guadeloupe.

GRAMINEÆ.

Paspalum cæspitosum, *Flügge.*—V. 1977; B. 376. Jamaica and Cuba to Guiana.

Paspalum compressum, *Nees.*—V. 192, 1106, 1109; B. 17, 378. West Indies and Central America southward to Ecuador and Paraguay.

Paspalum conjugatum, *Berg.*—V. 1100; B. 377. Central America, West Indies, and tropical South America; also tropical Asia and Africa.

Paspalum densum, *Poir.*—V., Guilding. Cuba and Mexico to Brazil.

Paspalum distichum, *L.*—V. 300, 1672, 1980; B. 22, 359, 360. Very widely dispersed in warm countries, including Chili.

Paspalum fimbriatum, *H. B.K.*—V. 831, 1374; U. 50. West Indies, New Grenada and Brazil.

Paspalum plicatulum, *Michx.*—V. 970, 1111. North America, Mexico, West Indies, Columbia to Brazil.

Paspalum saccharoides, *Nees.*, syn. Tricholœna saccharoides, *Griseb.* —V. 601. Trinidad, Dominica, Martinique, Panama and Venezuela.

Paspalum setaceum, *Michx.*—V. 832, 1978, 1979; M. 62. From Massachusetts and Illinois southward through Mexico, Bermudas, and the West Indies to Brazil.

Paspalum sieberianum, *Steud.*—V. 800, 808. West Indies.

Paspalum virgatum, *L.*—V. 80; B. 357. West Indies, Central America, Guiana, New Grenada, Brazil and Paraguay.

Eriochloa polystachya, *H. B.K.*, syn. E. punctata, *Hamilt.*—V. 566, 1096, 1353; B. 20, 25. Southern United States, West Indies, and Mexico southward to Uruguay, and widely dispersed in the warmer regions of the Old World.

Isachne arundinacea, *Griseb.*—V. 361, 650. Jamaica, Martinique, and Venezuela.

Panicum brevifolium, *L.*—V. 185. West Indies, Central America and Columbia, to Peru and Brazil.

Panicum colonum, *L.*—V. 582, 1098; B. 21, 367; M. 67. West Indies; common in all tropical countries.

Panicum costatum, *Roxb.*, syn. P. flavescens, *Sw.*—V. 314, 641, 1097, 1102, 1352, 1669. West Indies, tropical Africa and Asia.

Panicum divaricatum, *L.*—V. 375, 971, 1105, 1976. South Florida, West Indies, Central and South America.

Panicum fasciculatum, *Sw.*, syn. P. fuscum, β. fasciculatum, *Sw.*—V. 565, 1100, 1670; B. 22, 366, 369. West Indies, Mexico, and tropical South America.

Panicum frondescens, *Mey.*—V. 187. Trinidad, Guiana, Brazil.

Panicum horizontale, *Mey.*, syn. Digitaria setigera, *Roth.*—V. 322, 693, 931, 1108; B. 375; M. 59; U. 40. West Indies. All tropical countries, and the Cape of Good Hope, according to Grisebach. A variety of *P. sanguinale*, L.

Panicum leucophæum, *Kunth*, syn. Tricholæna insularis, *Griseb.*—V. 392, 1094, 1354; B. 23, 356; U. 43, 44. Texas, West Indies, Mexico, and Central and South America.

Panicum linkianum, *Kunth*, syn. Digitaria marginata, *Link.*—V. 231, 1107. West Indies. Common in tropical America, including Mexico and Central America. According to Grisebach widely dispersed in the tropics of the Old World. Usually regarded as a form of the very widely diffused *P. sanguinale*, L.

Panicum maximum, *Jacq.*—V. 288; M. 68. West Indies and Mexico to Brazil; originally introduced into America from Tropical Africa, according to Humboldt. (Guinea Grass.)

Panicum palmifolium, *Poir.*, syn. P. plicatum, *Lam.*—V. 226. Jamaica, Dominica, Trinidad, tropics of the Old World.

Panicum pilosum, *Sw.*, syn. P. distichum, *Lam.*—V. 163, 1104, 1975. West Indies, Central and South America.

Panicum prostratum, *Lam.*—B. 19; C. 23; M. 63. Tropics of both hemispheres. V. 370 and 1356 are also doubtfully referred to this species.

Panicum sanguinale, *L.*—V. 247. West Indies. Almost everywhere in tropical and sub-tropical countries.

Panicum, *sp.*—V. 1099.

Ichnanthus candicans, *Doell*, var. **glabratus**, *Doell.*—V. 127. Brazil.

Ichnanthus pallens, *Doell*, syn. Panicum pallens, *Sw.*—V. 1095. West Indies, Central America to Venezuela and Peru and Brazil, also in Tropical Asia.

Oplismenus loliaceus, *Beauv.*, syn. Orthopogon loliaceus, *Spreng.*—V. 136. West Indies and Mexico to Brazil.

Setaria caudata, *Rœm. & Schult.*, syn. S. setosa, *Beauv.* β. caudata, *Griseb.*—V. 463, 835; B. 367, 371. West Indies, Texas and New Mexico southward to Uruguay.—V. 1101 is also doubtfully referred to this species.

Setaria glauca, *Beauv.* — V. 265. West Indies; in nearly all temperate and tropical countries.

Cenchrus echinatus, *L.*—V. 108; B. 345; M. 58. A very widely dispersed species, ranging from Canada to Brazil, also in tropical Asia and Africa.

Cenchrus myosuroides, *H. B.K.*—V. 357. Cuba, Mexico, Columbia and Peru.

Pennisetum setosum, *Rich.*—V. 78, 1093; B. 348. West Indies and Mexico to Brazil, also in tropical Asia and Africa.

Stenotaphrum americanum, *Schrank.*—V. 212, 372. Widely distributed both in America and the Old World, chiefly in maritime districts.

Olyra latifolia, *L.*—V. 241. Throughout the West Indies, Mexico, and Central America, to Columbia, Guiana and Brazil.

Olyra pauciflora, *Sw.*—V. 1673. Jamaica, Antigua, St. Domingo, Cuba, and Mexico to Columbia, Guiana, Brazil and Paraguay.

Pharus brasiliensis, *Raddi*, syn. P. glaber, *H. B.K.*—V. 424; B. 350. West Indies, Florida, Mexico, New Grenada and Guiana to Brazil and Paraguay, also Peru.

Pharus latifolius, *L.*—V. without number. Throughout the West Indies, and in Mexico, southward to Ecuador and Brazil.

Pariana sylvestris, *Nees.*—V., Guilding. Perhaps introduced according to Grisebach. Brazil.

Coix Lacryma-Jobi, *L.*—V. 602. West Indies. Grisebach treats it as an introduced plant. Now common in the tropics of both hemispheres.

Oryza sativa, *L.*, syn., O. latifolia, *Desv.*—V. 1113. Trinidad and Cuba. Now cultivated in all warm countries, and also more or less established in a wild state.

Arundinella martinicensis, *Trin.*—V. 1358. West Indies.

Anthephora elegans, *Schreb.*—V. 102; B. 344; M. 61; U. 49. West Indies, Mexico and Central America to Columbia, Peru and Brazil.

Manisuris granularis, *Sw.*—V. 1112. Very widely diffused in the warmer regions of both hemispheres.

Ischæmum latifolium, *Kunth*, syn. Ischæmopogon latifolius, *Griseb.*—V. 361, 650. West Indies, Mexico and Central America to Ecuador, Peru and Brazil.

Andropogon bicornis, *L.* syn. Anatherum bicorne, *Beauv.*—V. 409. Tropical America.

Andropogon brevifolius, *Sw.*—V. 847. Tropical, more rarely subtropical, regions of both hemispheres.

Andropogon condensatus, *H. B.K.*—V. 845. Martinique, Trinidad, and Mexico, to Paraguay and Argentina.

Andropogon saccharoides, *Sw.*—V. 1973; B. 18, 24; M. 65. Extending from the Southern United States to Chili and Argentina.

Andropogon squarrosus, *L. fil.*, syn. Vetiveria arundinacea, *Griseb.*—V. 362. West Indies and Brazil, also India, Malaya and Mauritius. Grisebach suspects this plant to have been introduced from India.

Andropogon, *spp.* undetermined.—V. 1351, 972.

Sorghum halepense, *Pers.*—V. 165, 351, 352. Introduced from the Old World, and now cultivated and more or less naturalised in the warmer parts of America.

Sporobolus indicus, *R. Br.*—V. 585, 603. Common and generally dispersed in tropical and subtropical regions of both hemispheres.

Sporobolus virginicus, *Kunth.*—V. 348; B. 365; M. 55; U. 45. Common and very widely diffused in tropical and subtropical regions, especially in maritime districts.

Cynodon Dactylon, *Pers.*—V. 290; B. 362; M. 56. Bahamas, Jamaica and Antigua. In tropical and temperate countries all over the globe, but often sown and probably not indigenous in America.

Chloris radiata, *Sw.*—V. 232, 581; B. 358. Cuba and Panama to Peru and Brazil.

Bouteloua *sp.*—V. 1355.

Eleusine ægyptiaca, *Desf.*, syn. Dactyloctenium ægyptiacum, *Willd.*—V. 342, 1671; B. 355; M. 57; U. 42. Almost all warm countries throughout the world, though often only a colonist.

Eleusine indica, *Gærtn.*—V. 100, 276; B. 354; M. 60; U. 48. Almost all warm countries throughout the world, but in many places only introduced.

Leptochloa longa, *Griseb.*—V. 213. Trinidad.

Leptochloa mucronata, *Kunth.*—B. 373, 374; U. 47. Virginia and Illinois, southward through the West Indies, Mexico, and Central America to Venezuela.

Leptochloa virgata, *Beauv.*—V. 577, 1357. Mexico and West Indies southward to Brazil.

Gynerium saccharoides, *H. B.K.*, syn. Arundo saccharoides, *Poir.*—V. 1092. Mexico and West Indies southward to Columbia, Guiana, and Brazil.

Eragrostis ciliaris, *Link.*—V. 844; B. 363, 364; U. 46. South Carolina to Panama, tropical South America, the Galapagos, and in tropical Asia and Africa.

Eragrostis pilosa, *Beauv.*—V. 525, 834. Temperate and tropical countries of the globe.

Eragrostis poæoides, *Beauv.*, syn. E. minor, *Host.*—V. 411. A very widely dispersed and variable grass.

Eragrostis. There are two undetermined species of this genus, namely, V. 1103 and B. 361.

Orthoclada rariflora, *Beauv.*, syn. O. laxa, *Beauv.*—V. 209. Mexico and West Indies southward to Peru, Guiana and Brazil.

FILICES.

GLEICHENIACEÆ.

Gleichenia pubescens, *H. B.K.*—V. 149, 907, 1361. Throughout tropical America.

Gleichenia pectinata, *Presl.*—V. 864. Throughout tropical America.

CYATHEACEÆ.

Cyathea arborea, *Smith.*—V. 156, 196, 947, 986, 1014, 1131, 1349. West Indies to Brazil.

Cyathea Serra, *Willd.*—V., Guilding. Throughout tropical America.

Cyathea Tussacii, *Desv.*—V. 962, 1018. West Indies and Venezuela.

Cyathea tenera, *Griseb.*—V., Caley. Endemic.

Hemitelia grandifolia, *Spring.*—V., Guilding. Throughout tropical America.

Hemitelia horrida, *R.Br.*—V. 801, 849, 854. West Indies and Venezuela.

Alsophila aspera, *R.Br.*—V. 696, 863, 1012, 1013. West Indies and Guiana.

Alsophila ferox, *Presl.*—V. 196, 987. Throughout tropical America.

Alsophila infesta, *Kunze.*—V. 292, 1717. Throughout tropical America.

HYMENOPHYLLACEÆ.

Hymenophyllum vincentinum, *Baker*, in *Ann. Bot.* vol. v., p. 164, t. 10.—A new species. V. 604, 1067; and var. **latifolium,** *Baker*, l. c. —V. 1066.

Hymenophyllum polyanthos, *Sw.*—V. 365, 611, 1062, 1063. Cosmopolitan.

Hymenophyllum hirsutum, *Sw.*—V. 364, 1070, 2071. Tropical and South temperate America and Mascarene Islands.

Hymenophyllum latifrons, *V.D.B.*—V. 1072. West Indies.

Hymenophyllum hirtellum, *Sw.*—V., Guilding. Throughout tropical America.

Hymenophyllum lineare, *Sw.*—V. 1069. Tropical America, Mascarene Islands and Natal.

Hymenophyllum ciliatum, *Sw.*—V. 254, 480, 965, 1074, 1075, 1076, 1077, 1365. Cosmopolitan.

Hymenophyllum valvatum, *H. & G.*—V. 1065, 1067. Throughout tropical America.

Hymenophyllum fucoides, *Sw.*—V., 851. Throughout tropical America.

Hymenophyllum Catherinæ, *Hook.*—V. 1068. Very rare in the highest mountains at about 3,000 feet; gathered previously only in Guadeloupe by L'Herminier, and in Jamaica, on St. Catherine's peak, at an elevation of 5,000 feet.

Trichomanes spicatum, *Hedw.*—V. 278. West Indies to Ecuador.

Trichomanes membranaceum, *L.* — V. 367. Throughout tropical America.

Trichomanes reptans, *Sw.*—V., Guilding. Throughout tropical America.

Trichomanes punctatum, *Poir.*—V. 412. Throughout tropical America.

Trichomanes muscoides, *Sw.*—V. 711, 1072. Cosmopolitan.

Trichomanes pusillum, *Sw.*—V. 425. Throughout tropical America.

Trichomanes brachypus, *Kunze.*—V., Guilding. Throughout tropical America.

Trichomanes quercifolium, *H. & G.*—V. 573. Throughout tropical America, also Natal.

Trichomanes Krausii, *H. & G.*—V. 952. Throughout tropical America.

Trichomanes sinuosum, *Rich.*—V. 665, 1078. Throughout tropical America.

Trichomanes Bancroftii, *H. & G.*—V. 580. Throughout tropical America.

Trichomanes Kaulfussii, *H. & G.*—V. 327. Throughout tropical America.

Trichomanes lucens, *Sw.*—V. 533. Throughout tropical America.

Trichomanes alatum, *Sw.*—V. 141. Throughout tropical America.

Trichomanes pyxidiferum, *L.*—V. 61, 322, 507, 628, 1081, 1724. Cosmopolitan.

Trichomanes rigidum, *Sw.*—V. 485. Cosmopolitan.

Trichomanes crispum, *Sw.*—V. 91, 892. Throughout tropical America.

POLYPODIACEÆ.

Dicksonia cicutaria, *Sw.*—V. 1723. Throughout tropical America.

Davallia aculeata, *Sw.*—V. 1722. West Indies.

Lindsaya guianensis, *Dryand.*—V. 1027, 1093. Throughout tropical America.

Adiantum Kaulfussii, *Kunze.*—V., Guilding. Throughout tropical America.

Adiantum intermedium, *Sw.*—V., Guilding. Throughout tropical America.

Adiantum trapeziforme, *L.*, var. cultratum, *J. Sm.*—V., Guilding. Throughout tropical America.

Adiantum obtusum, *Desv.*—V., Guilding. Throughout tropical America.

Adiantum macrophyllum, *Sw.*—V. Guilding. Throughout tropical America.

Adiantum tetraphyllum, *Willd.*—V., 194, 644, 957. Throughout tropical America, also West Africa.

Adiantum Capillus-Veneris, *L.*—V. 1895. Cosmopolitan.

Adiantum concinnum, *H.B. et K.*—V. 969. Throughout tropical America.

Adiantum villosum, *L.*—V. 540, 958. Throughout tropical America.

Adiantum tenerum, *Sw.* — V., Guilding. Throughout tropical America.

Cheilanthes radiata, *R.Br.*—V. 1721. Throughout tropical America.

Cheilanthes microphylla, *Sw.*—V. 1896. Throughout tropical America.

Pellæa geraniæfolia, *Fée.*—V. 1974. Cosmopolitan.

Pteris laciniata, *Willd.*—V. 260, 272, 960. Throughout tropical America.

Pteris aculeata, *Sw.*—V. 186. Throughout tropical America.

Pteris podophylla, *Sw.*—V., Guilding. Throughout tropical America.

Pteris longibrachiata, *Ag.*—V. 589. West Indies.

Ceratopteris thalictroides, *Brongn.*—V., Guilding. Cosmopolitan.

Lomaria attenuata, *Willd.*—V. 282. Cosmopolitan.

Lomaria Plumieri, *Desv.*—V. 1025. Throughout tropical America.

Lomaria procera, *Spreng.*—V. 838, 1023. Cosmopolitan.

Blechnum longifolium, *H. BK.*—V., Guilding. Throughout tropical America.

Blechnum occidentale, *L.*—V. 302, 966. Throughout tropical America.

Asplenium serratum, *L.*—V. 666. Throughout tropical America.

Asplenium alatum, *H. B.K.*—V., Guilding. Throughout tropical America.

Asplenium lunulatum, *Sw.*—V., Guilding. Cosmopolitan.

Asplenium obtusifolium, *L.*—V. 710. Throughout tropical America.

Asplenium auriculatum. *Sw.*—V. 188. Throughout tropical America.

Asplenium Serra, *L. & F.*—V. 207. Throughout tropical America, also tropical Africa.

Asplenium lætum, *Sw.*—V. 358, 961, 1119, 1121. Throughout tropical America.

Asplenium pumilum, *Sw.*—V. 1900. Cosmopolitan.

Asplenium cuneatum, *Lam.*—V. 453, 1118. Cosmopolitan.

Asplenium furcatum, *Thunb.*—V., Guilding. Cosmopolitan.

Asplenium rhizophyllum, *Kunze.*—V. 682, 1018, 1898. Throughout tropical America.

Asplenium cicutarium, *Sw.*—V. 875, 1897. Throughout tropical America, also tropical Africa.

Asplenium arboreum, *Willd.*—V. 1346. West Indies and Venezuela.

Asplenium Shepherdi, *Kunze.*—V. 712, 890, 1122, 1123, 1719. Throughout tropical America.

Asplenium crenulatum, *Baker.*—V. 373. Throughout tropical America.

Asplenium radicans, *Schk.*—V. 24, 36, 129, 386, 416, 926, 959, 960, 1124, 1125, 1126, 1127, 1128, 1344, 1345, 1363, 1899. Throughout tropical America.

Asplenium Godmani, *Baker*, in Ann. Bot., vol. v., p. 166, t. 11.—V. 1019. Since gathered by Mr. R. V. Sherring in Grenada.

Asplenium marginatum, *L.*—V. 326. Throughout tropical America.

Aspidium semicordatum, *Sw.*—V. 791, 944, 956. Tropical America and Asia.

Aspidium plantagineum, *Griseb.*—V. 171. Throughout tropical America.

Aspidium trifoliatum, *Sw.*—V. 140, 865, 867. Throughout tropical America; and var. **Plumieri**, *Presl.*—V. 829.

Nephrodium conterminum, *Desv.*—V. 964, 1130, 1360. Throughout tropical America.

Nephrodium Sprengelii, *Hook.*—V. 151. Throughout tropical America.

Nephrodium limbatum, *Desv.*—V., Guilding. West Indies.

Nephrodium patens, *Desv.*—V. 789. Cosmopolitan.

Nephrodium trichophorum, *Baker.*—V. 705. West Indies.

Nephrodium Jenmani, *Baker.*—V. 855. Known before only in Jamaica.

Nephrodium brachyodon, *Hook.*—V. 221, 451, 946. Tropical America and Asia.

Nephrodium effusum, *Baker.*—V. 862. Throughout tropical America.

Nephrodium villosum, *Presl.*—V. 292, 1021. Throughout tropical America.

Nephrodium amplum, *Baker.*—V. 138, 861. Throughout tropical America.

Nephrodium furcatum, *Hook.*—V. 860. Throughout tropical America.

Nephrodium molle, *Desv.*—V. 891. Cosmopolitan.

Nephrolepis exaltata, *Schott.*—V. 238. Cosmopolitan.

Oleandra nodosa, *Presl.*—V. 417. Throughout tropical America.

Polypodium flavo-punctatum, *Kaulf.*—V. 659. Throughout tropical America.

Polypodium decussatum, *L.*—V. 43. Throughout tropical America.

Polypodium crenatum, *Sw.*—V. 317, 697, 754. Throughout tropical America.

Polypodium tetragonum, *Sw.*—V. 89, 451, 785, 946, 1347, 1348; and var. **megalodus**, *Schk.*—V. 858, 1716. Throughout tropical America.

Polypodium gramineum, *Sw.*—V., Guilding. West Indies and Guiana.

Polypodium marginellum, *Sw.*—V. 170. Cosmopolitan.

Polypodium serrulatum, *Mett.*—V. 840. Cosmopolitan.

Polypodium trifurcatum, *L.*—V. 29. Throughout tropical America.

Polypodium trichomanoides, *Sw.*—V. 269, 933. Tropical America and Africa.

Polypodium flabelliforme, *Lam.*—V., Guilding. Throughout tropical America.

Polypodium jubæforme, *Kaulf.*—V. 42, 932. Throughout tropical America.

Polypodium suspensum, *L.*—V. 514, 937. Throughout tropical America.

Polypodium cultratum, *Willd.*—V. 943. Tropical America and Africa.

Polypodium taxifolium, *L.*—V. 919. Throughout tropical America.

Polypodium pectinatum, *L.*—V. 249. Throughout tropical America.

Polypodium sororium, *H. B.K.*—V. 406. Throughout tropical America.

Polypodium piloselloides, *L.*—V. 255, 658. Throughout tropical America.

Polypodium loriceum, *L.*—V. 144, 291, 293, 837, 945. Throughout tropical America.

Polypodium incanum, *Sw.*—V. 775. Cosmopolitan.

Polypodium aureum, *L.*—V. 688, 798, 1718, 1901. Tropical America.

Polypodium lycopodioides, *L.*—V. 85, 745, 1364. Cosmopolitan.

Polypodium repens, *L.*—V. 968. Throughout tropical America.

Polypodium Phyllitidis, *L.*—V. 173, 479. Throughout tropical America.

Polypodium crassifolium, *L.*—V. 1022. Throughout tropical America.

Monogramme seminuda, *Baker.*—V. 143. Throughout tropical America.

Gymnogramme calomelanos, *Kaulf.*—V. 83, 1114, 1115, 1117, 1720 var. **chrysophylla,** *Kaulf.*—V. 1116; and a handsome decompound finely-cut variety.—V. 325. Throughout tropical America.

Gymnogramme elongata, *Hook.*—V. 413. Throughout tropical America.

Meniscium reticulatum, *Sw.*—V. 191, 315. Throughout tropical America.

Antrophyum lanceolatum, *Kaulf.*—V. 389. Throughout tropical America.

Antrophyum subsessile, *Kaulf.*—V. 1017. Throughout tropical America.

Vittaria lineata, *Sw.*—V. 161. Cosmopolitan.

Vittaria remota, *Fée.*—V. 109. Throughout tropical America.

Tænitis angustifolia, *R.Br.*—V., Guilding. Throughout tropical America.

Tænitis lanceolata, *R.Br.*—V. 1028. Florida, Central America and West Indies.

Hemionitis palmata, *L.*—V. 973. Throughout tropical America.

Hemionitis citrifolia, *Hook.*—V. 438. Throughout tropical America.

Acrostichum conforme, *Sw.* var. **alatum,** *Fée.*—V. 967. Throughout tropical America.

Acrostichum latifolium, *Sw.*—V. 379, 1138. Cosmopolitan.

Acrostichum Herminieri, *Bory.*—V. 1139. Throughout tropical America.

Acrostichum apodum, *Kaulf.*—V. 380, 1137. Throughout tropical America.

Acrostichum Smithii, *Baker* in *Ann. Bot.* vol. v. p. 169.—V., 1105. A new species allied to A. lineare and Aubertii.

Acrostichum viscosum, *Sw.*—V. 376. Cosmopolitan.

Acrostichum villosum, *Sw.*—V. 1134. Throughout tropical America.

Acrostichum undulatum, *Willd.*—V. 1136. Throughout tropical America.

Acrostichum sorbifolium, *L.*—V. 608. Cosmopolitan.

Acrostichum cervinum, *Sw.* V. 281. Throughout tropical America.

Acrostichum aureum, *L.*—V. 593. Cosmopolitan.

Acrostichum præstantissimum, *Bory.*—V. 1039. West Indies only.

Acrostichum crinitum, *L.*—V. 1133. Mexico and West Indies.

MARATTIACEÆ.

Marattia alata, *Sm.*—V., Guilding. West Indies and Central America.

Danæa alata, *Sm.*—V. 279. West Indies.

Danæa nodosa, *Sm.*—V. 307, 692, 1024, 1027, 1029. Throughout tropical America.

LYCOPODIACEÆ.

Psilotum triquetrum, *Sw.*—V. 630. Cosmopolitan.

Lycopodium reflexum, *Lam.*—V. 1333. Throughout tropical America.

Lycopodium dichotomum, *Jacq.*—V. 1339. Throughout tropical America.

Lycopodium taxifolium, *L.*—V. 301, 735, 1337. Throughout tropical America.

Lycopodium linifolium, *L.*—V. 1335. Throughout tropical America.

Lycopodium funiforme, *Cham.*—V. 1334. Throughout tropical America.

Lycopodium cernuum, *L.*—V. 52, 1332. Cosmopolitan.

Lycopodium aqualupianum, *Spring.*—V. 1338. Throughout tropical America.

SELAGINELLACEÆ.

Selaginella portoricensis, *A.Br.*—V. 1377. West Indies.

Selaginella rotundifolia, *Spring.*—V. 1375. West Indies.

Selaginella apus, *Spring.*—V. 1376. United States and West Indies.

Selaginella flabellata, *Spring.*—V. 54, 119, 235, 1010. Cosmopolitan.

SUMMARY.

The foregoing enumeration includes all the plants collected by Mr. Herbert H. Smith and his assistant, Mr. George W. Smith, whether indigenous or naturalised. It also contains 179 flowering plants and 24 ferns not collected by them, though there are specimens preserved in the Kew Herbarium on sheets mostly marked "St. Vincent, Guilding," in the handwriting of the late Sir William Hooker. There are also a few sent from the same island by Alexander Anderson and others. As to the majority of those sent by the Rev. Lansdown Guilding there can be little doubt from what is actually known of their geographical distribution, supported by the fact that no subsequent traveller has collected them in the island, that the specimens were taken from plants cultivated in the botanic garden, or, in some cases perhaps, collected in the neighbouring islands. A few of them may exist locally or may have existed, such as *Cakile æqualis*, L'Her., for example, and were either overlooked by Messrs. Smith or they may have disappeared since Guilding's time. There is yet another category of plants inserted on the authority of the earlier collectors, namely, such as have never been found elsewhere and not again in the island. Among these are *Spachea perforata*, Juss. (Malpighiaceæ), and *Cyathea tenera*, Hook. (Filices). The former is represented in the Kew Herbarium by specimens presented by Guilding, and Jussieu (Monogr. Malpig., p. 75) states that there was a specimen in Delessert's herbarium from St. Vincent, collected by Caley, which probably belonged to the same species. This tree-fern is recorded by Grisebach (*Fl. Brit. W. Ind. Isds.*, p. 704) from Jamaica and elsewhere, but Mr. J. G. Baker (*Annals of Botany*, v., p. 171) mentions that the only specimen known is an imperfect one from St. Vincent, collected by Caley.

The total number of species of flowering plants collected in St. Vincent and the four adjacent islets, Bequia, Cannouan, Mustique, and Union, including naturalised plants, and those inserted on the authority of the early collectors, is about 1,150. Of these Mr. Smith collected 977, whereof at least 131 are almost certainly colonists, leaving 846 indigenous species, belonging to 490 genera and 109 natural orders. The number of species of flowering plants collected in the small islands was, respectively: Bequia, 375; Mustique, 160; Union, 49; and Cannouan, 30. With regard to the general distribution of the indigenous plants, the principal points are the wide geographical range of the majority and the smallness of the endemic element, conditions that obtain throughout the whole chain of islands from Tobago to the Virgin group, which are in striking contrast to the proportions of the endemic element in Cuba and Jamaica. There is no endemic genus in St. Vincent, but the following species have hitherto not been found elsewhere:—

Trigynæa antillana, Rolfe.
Spachea perforata, Juss.
Meliosma Herbertii, Rolfe.
Calliandra Guildingii, Benth.
Psidium guildingianum, Griseb.
Gustavia antillana, Miers.
Tibouchina cistoides, Griseb.
Begonia rotundifolia, Lam.
Hoffmannia tubiflora, Griseb.
Malouetia retroflexa, Muell. Arg.
Columnea speciosa, Presl.
Peperomia cuneata, Miq.
,, *vincentiana*, Miq.
Croton Guildingii, Griseb.
Epidendrum vincentinum, Lindl.
Tillandsia megastachya, Baker.

It is probable that the working out of all the specifically unnamed plants might result in some addition to the above list; but that was too laborious a task to undertake in connection with the flora of so small an area.

Beginning with those species of smallest extension beyond the island 198 are restricted to the West Indian Islands, and eight others extend only into Southern Florida. Grisebach (*Die Geogr. Verbr. der Pfl. Westindiens*, p. 55), states that 2,000 species, or nearly half of the West Indian species he had compared, were, so far as was then known, peculiar to the islands; but, although he estimated the number of endemic Cuban species at 849, and it doubtless is very high, the proportion of endemic species for the whole of the islands to the total indigenous species is much less than half. For the eastern chain of islands it is very low, as 565 out of about 850 of the St. Vincent plants are also continental American, and most of them widely dispersed there, but they do not occur in the Old World or Polynesia. Further, 29 species are also common to Africa, and 133 are more or less generally spread in the tropics. Returning to the rarest species of those not restricted to St. Vincent, it is interesting to note that they include species at present only known to inhabit St. Vincent and Trinidad, for example: *Brownea speciosa, Combretum eriopetalum, Couroupita antillana, Aspidosperma sessiliflorum, Solanum hirtum* and *Pilea ovalis;* to St. Vincent and Jamaica: *Voyria tenella, Solanum retrofractum,* and *Tillandsia compressa;* to St. Vincent and Cuba: *Triumfetta grossulariæfolia, Erithalis augustifolia,* and *Eupatorium ossæanum;* St. Vincent and St. Lucia: *Henriettella triflora;* St. Vincent and Dominica: *Begonia dominicalis* and *Stelis scabrida;* St. Vincent and Martinique: *Begonia martinicensis* and *Pleurothallis floribunda,* and St. Vincent and Hayti: *Echites circinalis.* Many apparently similar peculiarities in distribution might be given; but they do not possess much value, because a more thorough investigation might invalidate them. Nevertheless, so far as we can accept them as facts, they are interesting in relation to the spreading of plants in some localities and their extinction in others.

The predominating genera are :—

Cassia	12 species.
Psychotria	11 ,,
Ipomœa	18 ,,
Solanum	13 ,,
Piper	10 ,,
Peperomia	14 ,,
Epidendrum	11 ,,
Paspalum	11 ,,
Panicum	14 ,,
Hymenophyllum	10 ,,
Trichomanes	17 ,,
Adiantum	10 ,,
Asplenium	18 ,,
Nephrodium	12 ,,
Polypodium	25 ,,
Acrostichum	13 ,,

The twelve predominating natural orders :—

Leguminosæ	141 species.
Gramineæ	58 ,,
Rubiaceæ	52 ,,
Compositæ	45 ,,
Orchideæ	43 ,,
Euphorbiaceæ	38 ,,
Cyperaceæ	34 ,,
Melastomaceæ	25 ,,
Malvaceæ	24 ,,

Convolvulaceæ	- - -	23 species
Solanaceæ	- - -	22 „
Piperaceæ	- - - -	22 „

The Vascular Cryptogams have been elaborated by Mr. J. G. Baker (*Annals of Botany*, v. pp. 163–172, plates 10 and 11), from which the preceding list of species and following particulars are chiefly extracted. Excluding five striking varieties, which some botanists might regard sufficiently distinct to take specific rank, St. Vincent alone has yielded 163 species belonging to 35 genera. This includes 23 species ascribed to the island on the authority of Guilding and others, but not in the collection made by Mr. Smith. One of these is the apparently endemic *Cyathea tenera*, and the distribution of the other 22 is such, that in Mr. Baker's opinion, they might occur in any of the West Indian islands. In any case the fern vegetation is very rich and varied, and in relation to the area far in excess as to number of species to that of New Zealand, which is generally regarded as one of the most highly concentrated. A glance down the list is sufficient to ascertain that a large majority of the species have a wide distribution; but in addition to the one already mentioned, there are four endemic species, namely, *Hymenophyllum vincentinum*, *Pteris longibrachiata*, *Asplenium Godmani*, and *Acrostichum Smithii*.

Altogether the vegetation of St. Vincent is varied and luxuriant, bespeaking a fertile soil and a favourable climate.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

Nos. 82, 83.] OCTOBER—NOVEMBER. [1893.

CCCXXXVI.—BOTANICAL EXPLORATION OF SIKKIM-TIBET FRONTIER.

The following documents have been forwarded to Kew by the Government of Bengal. They are reprinted partly on account of the intrinsic interest of the report, which deserves to be made more accessible, partly because it supplements in some respects the classical exploration of the same region made by the late Director of the Royal Gardens, Sir Joseph (then Doctor) Hooker, in the years 1848-9.

Mr. G. A. Gammie is an assistant in the Government Cinchona Plantations at Mungpoo, of which his father, Mr. J. A. Gammie, is the well known deputy superintendent.

238 packets of seeds, collected mostly at high level by Mr. G. A. Gammie, were sent to Kew by Dr. King, Superintendent of the Royal Botanical Gardens, Calcutta.

(No. 41B.S.I., dated Calcutta, the 26th July 1893.)

From George King, Esq., M.B., LL.D., F.R.S., C.I.E., Superintendent Royal Botanical Gardens, Calcutta, and of Cinchona cultivation in Bengal, to the Secretary to the Government of Bengal, Financial Department.

I have the honour to forward herewith in original the report made by Mr. G. Gammie on his botanical tour made on the Sikkim-Tibet frontier in the summer of 1892. This report was sent to his Honour the Lieutenant-Governor's Private Secretary on 28th April 1893, as Sir Charles Elliott wanted to see it prior to his departure for Europe. It was returned to me by the Hon. H. H. Risley on 26th June 1893, with a demi-official letter asking me to direct Mr. Gammie to prepare an account of the vegetation of Sikkim suitable for a Gazetteer.

Account of a Botanical Tour in Sikkim during 1892, by G. A. Gammie.

I departed to collect botanical specimens in Sikkim and on its frontiers on the 6th June 1892. As Mr. White, the political agent, informed me that he would probably be at liberty to accompany me on a journey to the little known district of Lhonak, I arranged to meet him at Guntok in about six weeks' time, when we should make the necessary arrangements for our travelling together. To my disappointment, the exigencies of his appointment prevented him from carrying out his intention, and I was obliged to abandon the idea of going alone to Lhonak, as Mr. White considered it inadvisable on my part to attempt it while important negotiations concerning the frontier were pending with the Tibetans.

He kindly forwarded to me parwanas written in Tibetan and addressed generally to the headmen of villages, ordering them to render me whatever assistance I required, but at the same time he wisely advised me not to depend on procuring carriers or supplies from the inhabitants. His passports were of the utmost value to me on the rare occasions I had to avail myself of assistance from the villagers, a service these indolent people would have been loth to afford me had I not been supported by such indisputable authority. As I had no hopes of procuring supplies in the country, I made thorough arrangements for food sufficient for all to be sent at intervals to different stations, regulating my movements in accordance with the plans laid down, thus at all times avoiding a possible scantiness of rations, which would have disheartened my men and caused their desertion, a most undesirable contingency.

The slothful and improvident habits of the inhabitants prevent them from growing more grain than is actually necessary for their bare subsistence, a condition of affairs concomitant with their lack of mercantile enterprise, which is probably due to their isolation from the outer and more civilised world.

Being thrown on my own resources, and having permission from Mr. White to travel in any part of the country, excepting Lhonak and Cholamoo, I decided to devote the remainder of the allotted time to exploring the Lachung valley with its ramifications, the Lachen valley and the Chola range from Tumloong to the Zeylap La, from whence I could return to Darjeeling by the Gnatong road.

In anticipation of the meeting with Mr. White, I considered that the first month of deputation would be most usefully spent in traversing the Singalelah range to Kinchinjunga, from which I could march to Guntok by way of Yoksun.

As I was requested to confine my attention as much as possible to the collection and observation of temperate and alpine vegetation, that of low elevations being already well understood, I must omit anything but casual mention of the tract between Yoksun and Tumloong, and also the valley of the Teesta to the junction of the Lachen and Lachung. This restriction divides my narrative into three parts, the first dealing with the vegetation of the exceedingly moist mountains forming the western boundary of Sikkim, the second with that of the temperate and drier territory north of the junction of the Lachen and Lachung, and the third with that of the Chola range.

First Tour.—Journey along the Singalelah range to the tracts on the southern flank of Kinchinjunga, and the march across the valleys of the Ranjit and Teesta to Tumlung.

This excursion lasted from the 7th June to the 7th July. The rainy monsoon broke with almost unparalelled severity on the day of my departure, and the most interesting portion of the journey, namely, that at high elevations, was accomplished through incessant fogs and storms of wind and rain. I thus enjoyed few opportunities of viewing the surrounding scenery, and had perforce to confine my observations to the vegetation within access to practicable paths.

The Singalelah range is an elevated mountain mass, springing from the face of Kinchinjunga, and extending southwards to the plains of India. Owing to the facilities of travelling afforded by the Nepal frontier road to Phalut, the range so far is much frequented by general travellers, and is, in consequence, too well explored to induce one to linger on the way in search of novelties. Some yew trees (*Taxus baccata*) grow close to the road beyond Tonglu, and ***Abies webbiana*** is first seen on the last ridge between Tonglu and Sandakphu; from thence onwards it exists in profusion up to 13,000 feet in elevation, covering mountain sides with dense and sombre forests. There are trees of *Tsuga brunoniana* below Phalut, and ***Juniperus Pseudo-Sabina*** abounds near the path to Cheabhanjan; but the other species of conifers, so characteristic of drier Sikkim, are altogether absent. Above 11,000 feet the most notable plants are aconites and *Meconopsis Wallichii*, and a few species each of the genera *Ranunculus*, *Anemone*, *Potentilla*, *Primula*, &c. *Fragaria daltoniana* occurs here and there, bearing narrow oblong fruits, reminding one of small strawberries, and resembling them in flavour. The road from Sandakphu to Phalut passes through a forest of *Abies webbiana*, associated with *Pyrus foliolosa*, *Betula utilis*, *Acer caudatum*, and *Prunus rufa*, &c.; underneath them are thickets of various rhododendrons and two species of bamboo. One of the latter is *Arundinaria spathiflora*, which flowered two years ago, a fact attested by the dead culms still bearing the withered spathe-like sheaths of the inflorescence. Its average height is 10 to 12 feet. The other is what Mr. Gamble named *A. gammieana* from specimens of the foliage only, but having since examined flowers, he has discovered it to be *A. racemosa*, Munro, a plant which, although so abundant round Darjeeling as to be almost exclusively used as fodder for ponies, has never been known to flower there. The Phalut plant, which differs so much in size and appearance, having reddish stems with an average height of 3 feet, may, of course, owe its diminution to the more rigorous climate of higher levels preventing its attainment to a normal growth. These two bamboos, the most Alpine species in Sikkim, grow in impenetrable scrubs in the same spongy soil which affords support to rhododendrons and pines.

On the slopes immediately below the summit of Phalut arboreal vegetation is scanty, and confined to sheltered ravines. The ground is everywhere covered with a sward of herbaceous plants. *Anemone rivularis*, with blue and white flowers, predominates. *Primula rotundifolia* and *P. sikkimensis* (the latter affecting marshy situations in company with *Calathodes palmata*) are common. *Meconopsis Wallichii* is extremely abundant. The Bhutias eat the young stems of this plant, and the shoots of a *Polygonatum* are much esteemed by the Gurung shepherds. The young shoots of bamboos are cooked and eaten. *Rheum acuminatum* is prevalent throughout the whole of Alpine Sikkim, but is not utilised as food. *Allium Wallichii*, which is equally abundant, is consumed largely, sharing with the common onion the reputation of being an efficacious antidote against the physical discomforts experienced by men and animals at high elevations.

From Cheabhanjan onwards to Kinchinjunga the only available path is that used by the shepherds, who pasture their flocks along the whole range during summer. For many miles this track follows the contour of the spur's crest, so that every day's march comprises many descents and ascents. As might be inferred from the proximity of the path to the ridge, streams supplying a sufficiency of water for our camp were few and far between, often necessitating long marches to obtain our two chief desiderata—a space large enough to contain our tents, and water for cooking. At the end of the first day we found such a place at Ewanangi, a halting stage for shepherds. Its elevation by B. P. thermometer was 11,174 feet. The camping ground was covered with young plants of the formidable *Cnicus eriophoroides*, a large thistle. At the commencement of this march we struck the Islumbo Pass, and continued in a northerly direction. The path runs through woods of *Rhododendron arboreum*, *R. cinnabarinum*, *R. Falconeri*, *R. barbatum*, and *R. Hodgsoni*, *Acer caudatum*, *Betula utilis*, *Pieris ovalifola*, *Juniperus Pseudo-Sabina*, *Abies webbiana*, *Prunus rufa*, *Arundinaria spathiflora*, &c. These trees grow so densely that very few herbaceous plants exist beneath them. *Saxifraga ligulata*, a few species ot *Polygonum*, ferns of two species, and potentillas being most in evidence. A variety of beautiful mosses grow on the rocks. On open knolls the soil is carpeted with *Gaultheria nummularia* and the heather-like *Cassiope fastigiata*.

The following day's march was from Ewanangi to Megu. Two gentians become common about 12,000 feet. One, *Gentiana stylophora*, with large, terminal, greenish, lily-like flowers; the other *Swertia Hookeri*, conspicuous by its brown leaves and inflorescence, growing together in whorls on a stem often 6 feet high. A white and pink primula is common, *Rhododendron Anthopogon* is abundant. Its fragrant leaves are largely collected and burned as incense in Buddhist temples. Small trees are represented by the species of rhododendron formerly enumerated, to *Pyrus foliolosa*, *Prunus rufa*, and the bushy variety of *Juniperus recurva*, which forms excessively close thickets. *Spiræa bella* and *Pyrus rhamnoides* grow in open situations. *Clematis montana*, with large white flowers, climbs over bushes, and at once arrests attention. A succession of steep ascents and descents (where we first saw plants of *Meconopsis simplicifolia* in flower nestling under berberry bushes) was followed by a comparatively level path running over the rocks of glacial deposit, at the end of which lay the large and grassy flat of Megu, whose elevation by B. P. thermometer was 12,767 feet. Its bright green surface was interspersed with many plants of white primroses and yellow calathodes, a refreshing sight after travelling through such a long waste of rhododendrons. A colony of marmots lived in the rocks above the camping ground. I always understood that they avoid the damp climate of the Sikkim mountains, and live only in the dry regions beyond the snows. The tailless rat, another denizen of the same dry climate, was represented by numerous individuals scampering amongst the rhododendrons. A great extent of land beyond the camping ground is swampy, and covered with *Rhododendron campanulatum*. The stepping stones across the wettest parts are formed of slabs of a slate like gneiss, which are resonant when struck. Various species of *Sedum* of the section *Rhodiola* and the golden *Chrysosplenium alternifolium* are common in the clefts of stones, partly submerged in the water. The ridge above is steep, and its black barren crags of foliated gneiss present a most forbidding appearance.

The following day we marched to Gambothan. Since we left Phalut our marches had been along the crest of the Singalelah, excepting when we rarely descended to and traversed the Nepalese side; but here the path, after running through the swamp at Megu, ascends steeply and passes to the Sikkim side through a narrow depression guarded on each side by weatherworn cliffs. Grass covers this ascent, and the bright blue flowers of *Primula pusilla*, *P. glabra* and *Delphinium alpinum*, give an unique character to the place by their plentiful presence. In the clefts of a rock we found a small simply pinnate *Polypodium* and a species of *Pellæa*.

The tract into which we emerged wore a different aspect to that we had just left. Above us towered enormous walls and pinnacles of bare rock, intersected by equally stony valleys, all tending towards the broad and terraced slope over which we marched without difficulty. *Rhododendron Anthopogon* and *R. setosum* were the only woody plants. On the sides of the rocks along the terraces *Saxifraga imbricata* and *S. jacquemontiana* grew in dense mosslike cushions, spangled with white and yellow flowers. The soil is covered with a thick turf of grass and sedges, amongst which are innumerable plants of *Primula Stuartii* and a species of *Anemone*. Beyond this first terrace the route led over alternate flats and ravines, and passed four lakes. At first the rocks near the path are scattered singly over the ground ; further on the whole surface of the hill is covered by a confused mass of glacier deposited boulders, where the path is marked at intervals by upright white stones. Very little vegetation, except moss, maintains an existence in this wilderness. Sir Joseph Hooker, in his admirable account of the Physical Geography of Sikkim, thus explains the cause of this barren desolation :—Glaciers again descend to 15,000 feet in the tortuous gorges which immediately debouch from the snows of Kinchinjunga, but no plants grow on the *debris* they carry down, nor is there any sward of grass or herbage at their base, the atmosphere immediately around being chilled by enormous accumulations of snow, and the summer sun rarely warming the soil."

Attaining a ridge marked by a rudely built monument, bearing a small flag, we descended a steep gorge down which a stream urged its turbulent course. Its bed was cumbered with gneiss blocks with many of a fine grained granite transported from higher levels. This stream effects a junction with two others to form the Rangbi river at a flat expanse called Gambothan. The sheltered situation of this place favours the growth of large pine trees, and copses of a willow, *Salix wallichiana*, fringe the river bank. From eastward another tributary flows through a broad grassy valley, which rapidly attains a high elevation, and for a short distance towards the south the united rivers flow calmly through a forest of *Abies webbiana*. The most noteworthy plant growing in the desolate locality we had traversed is the gigantic rhubarb, *Rheum nobile*, always associated in the traveller's mind with barren precipices, where they delight to grow, and where they heighten the weird effect of such scenery by their cadaverous stave like stems, for only by closer inspection can the actual beauty of the plant be realised. The only perfect specimens existed on inaccesible rocks, as the shepherds collect and devour all they find within reach.

The elevation of Gambothan by B. P. thermometer was 12,400 feet.

Leaving Gambothan, a steep ascent was made to the summit of the ridge—13,300 feet in elevation. For half the distance there is a scattered forest of *Abies webbiana*, *Juniperus recurva*, *Rhododendron campanulatum*, *Prunus rufa*, and *Betula utilis ;* the upper part was almost wholly occupied by *Rhododendron Anthopogon* and *R. setosum* These, when bruised or trodden upon, exhale a strong perfume from the superficial glands with which they are covered, aggravating the headaches to which all are subject at high elevations. *Gentiana stylophora* is exceedingly common. Beyond the ridge is the broad open summit of Bokto, covered with grass, on which two large flocks of sheep were feeding. From this a descent has to be made into the valley of the Yangsap through dense growths of rhododendrons, *Abies* *webbiana*, *Pyrus foliolosa*, and *P. microphylla;* beyond is a steep hill almost devoid of vegetation and covered with boulders. The path winds up its right flank to a depression below its summit at about 14,000 feet elevation. There is a good wood of *Juniperus Pseudo-Sabina*, and the shrubby vegetation mainly consists of a *Berberis* not yet in leaf. Descending somewhat we crossed two small plains with a steep low ridge intervening. On these level tracts, intersected with sheep walks, it would have been almost impossible to keep the proper paths had not the shepherds marked them with upright slabs of stones at regular distances. Leaving the second plain, a steep scramble along the inclined foot of an enormous black gneiss cliff brought us to the bank of Ratong river, on whose further side we camped on a flat grassy knoll, the only cleared spot in a waste of rhododendrons.

Next morning we took the Kanglalama path and continued up the valley towards the north-west. We crossed one or two alternating flats and transverse ridges, and surmounted a high spur, coming out on a large plain rendered exceedingly swampy by a network of shallow streams. It seemed of very large extent, but we could not define its boundaries through the fog. There was no inducement to stop or proceed further in this direction, so we retraced our way to within a short distance of our last camping ground, and then ascended a grassy slope to the east. The descent on the other side led steeply through grassy pastures in which grew a species of *Astragalus*, and a dark purple species of *Anemone*. The floor of this valley is also a succession of terraces, each terminated by a bank, over which the river pours in masses of foam. There are signs of a more varied vegetation later in the season, but at present there is very little scope for botanizing. *Primula denticulata* and *P. reticulata*, resembling *P. sikkimensis*, grow on the verges of the watercourses. The valley lower down descends precipitately, and the flanks of its spurs are clothed with pine forests. The next day we halted at this place, called Rongjing by the shepherds. As rainy weather had prevailed without intermission since the commencement of this expedition, my men were quite disheartened, and being afflicted with complaints induced by wet and cold, begged me to hasten into the warmer valleys of Sikkim.

Being reluctant to subject them to further hardships in this inhospitable region, I acceded to their request, and informed them that I should go to Yoksun after spending a few days at Jongri, a locality I was anxious to see, as it was the goal of one of Sir Joseph Hooker's most heroic expeditions.

Returning to Tegyap La, we followed the course of the Ratong for about a mile, crossed it by a bridge and travelled eastwards up a very steep hill covered with rhododendrons; *Cryptogramme crispa* was plentiful along the path. The entrance to the undulating top of Jongri is marked by a shallow lake, said to be dry in the winter. We camped on a terrace immediately below two stone huts. Many plants were springing up amongst the grass, but the only ones in bloom were *Potentilla peduncularis*, *P. microphylla*, *P. coriandrifolia*, *P. albifolia*, *Primula reticulata*, *P. Stuartii*, *P. pusilla*, *P. glabra*, *Pedicularis siphonantha*, *Geranium polyanthes*, *Ranunculus affinis*, *Meconopsis simplicifolia*, and *Phlomis sp*. A majestic species of *Meconopsis* grew near the huts in dense clusters 2 to 3 feet high. The flowers vary in diameter from 5 to 7 inches, are an intensely vivid blue on opening, and change afterwards to purple. I was informed by the Bhutias that it was not a native of Sikkim, but had been introduced by them from Nepal. The mountain top of Jongri, which is admirably described by Sir J. D. Hooker, is formed of alternating knolls and hollows ranging from 13,000 to 14,000 feet. Much of its surface is covered with *Rhododendron Anthopogon*, to the exclusion of other vegetation. To the east of the camping ground is a wood of rhododendrons, mostly *R. lanatum* and *R. campanulatum*. About 12,500 feet *Primula pulchra* flourishes on the rocks.

After staying a few days at Jonrgi, I marched down to Yoksun. For about a mile the path runs eastward along Jongri, and then descends steeply for 7,000 feet, enabling one to pass in review the gradation of vegetation from alpine regions to the sub-tropical zone. A few gigantic yew trees grow a little above the Ratong. After crossing the Ratong, we travelled along the slopes on its left bank by one of the most difficult and dangerous paths in Sikkim, to Yoksun. This place is unique from its peculiar formation amidst such precipitous surroundings. The copsewood which once enhanced the beauty of the flat is now reduced to a gaunt gathering of pollarded and charred trunks, but the beautiful little lake is still surrounded by forest trees. Here, and everywhere in Sikkim at the same elevation, there are large areas covered with *Edgeworthia Gardneri*.

I halted for two days to allow my men to recuperate in such a congenial climate. *Polypodium rostratum*, so rare in the Darjeeling district, is the commonest fern. As Mr. Gamble once told me that Mr. Levinge had found it growing on the same rhizome with *Drymoglossum carnosum*, I searched carefully for a confirmation of the fact, but I failed to find any instance of it; indeed I did not perceive one plant of the latter species.

Variety of ferns is a notable feature of Yoksun. The commonest are *Polypodium rostratum*, *P. membranaceum*, *P. lineare*, *P. Boothii*, *P. fissum*, *P. amœnum*, *P. Lachnopus*, *P. argutum*, *Nephrodium hirtipes*, various varieties of *N. Filix-mas*, two forms of *Aspidium aculeatum*, one of *A. auriculatum*, *Oleandra neriiformis*, *Pteris aquilina*, *P. wallichiana*. Of Orchids I observed *Malaxis sikkimensis*, *Microstylis biloba*, *Cœlogyne ochracea*, *C. cristata*, *Otochilus sp.*, *Eria alba*, *Cymbidium hookerianum*, *Dendrobuim chrysanthum*, *Saccolabium calceolare* and a species of *Calanthe* in leaf. *Remusatia vivipara*, *Amorphophallus sp.*, *Arisæma speciosum*, *Hedychium coronarium*, and *Piper nepalenisis* were common on the rocks. The principal trees are *Erythrina arborescens*, *Castanopsis tribuloides*, *Pieris ovalifolia*, and two species of *Aralia*. The shrubby vegetation is composed of *Mæsa rugosa*, *Edgeworthia Gardneri*, and *Dichroa febrifuga*, *Camellia drupifera*, and a few other species. The villagers grow clumps of *Bambusa Falconeri* and a few plants of *Arundinaria hookeriana* have recently been planted near the lake. This beautiful bamboo abounds in Sikkim from 5,000 to 7,000 feet, and is the kind exclusively used for roofing temples and houses. For this purpose the culms are cut into short lengths, flattened out, and laid on as shingles. They are said to be very durable and make perfectly watertight roofs.

The cultivated crops are buckwheat, millet, and a little maize. After the grain is sown no care is taken to keep the fields in proper cultivation. One enclosed plot was full of ganja plants (*Cannabis sativa*) in splendid condition.

From Yoksung I marched to Tumloong through tropical and sub-tropical vegetation similar in all respects to that of the Darjeeling district.

By comparison with the drier regions of Upper Sikkim, which I afterwards visited, I considered that the main characteristic of the vegetation along the Singalelah range is its poverty in variety of forms and its superabundant wealth in individual species of rhododendrons. I only collected about 200 species of plants in flower and fruit. There was, however, evidence to prove that the floral harvest would have been more remunerative later in the season. Dr. Hooker, in his appendix on the Physical Geography of Sikkim, states "their banks " (or rivers) between 8,000 and 14,000 feet are generally covered with " rhododendrons, sometimes to the total exclusion of other wooded " vegetation, especially near the snowy mountain, a cool temperature " and great humidity being the most favourable conditions for the " luxuriant growth of this genus." Such conditions prevailing throughout the Singalelah range, due to its proximity to Kinchinjunga, account for the overwhelming abundance of rhododendrons, and may also be accepted as probable reasons for the comparative absence of herbaceous plants (in ordinal and generic forms), which are unable to maintain a struggle for existence in such an adverse climate and against such formidable competitors.

Second Tour. The Lachung Valley.—I arrived at Tumloong on the 7th July, and was detained there until the 24th waiting for supplies which were delayed by the break of communications caused by the excessive rains.

Immediately on their receipt I commenced my second excursion, and marched through the hot tropical valley of the Teesta, arriving at Choongtam at the junction of the Lachen and Lachung rivers on the 28th. Near Choongtam a remarkable transition from tropical to temperate vegetation takes place, with no palpable increase of elevation. *Cnicus involucratus*, *Astragalus pycnorrhizus*, *Eupatorium cannabinum*, *Anemone vitifolia*, and a few other plants, served to accentuate the change. *Leptocodon gracilis*, a fragile climber with blue flowers, rambled over bushes everywhere. I collected many specimens of *Pleopeltis rhynchophylla* from a tree at the end of the Lachung cane bridge.

The hill above Choongtam ascends abruptly to 10,000 feet, and is almost entirely clad with grass alone. It forms the termination of a lofty range running southwards from Kinchinjhow, and divides the Lachen and Lachung valleys. The Tibetans aver that this long spur possesses but one practicable pass, namely the Sebo La between Momay Samdong and Tungu, but by dint of persistent enquiry I discovered that there are at least two more—one from Lachung to somewhere near Latong, the other from Yeumtong to Tallum Samdong. I was informed that they are rarely used, a fact explained by the lack of the necessity of frequent intercourse between the inhabitants of the two valleys.

From Choongtam we marched to the village of Lachung in one day. As far as Keadom the valley is narrow, and the path runs along the river bank for most of the way. Here the valley expands into a large flat, with an elevation of 6,600 feet, which enjoys such a warm and sunny climate that maize, millets, and other tropical crops are successfully cultivated. Onwards the valley again becomes narrow, but two or three miles below Lachung it broadens considerably, and remains open for some miles above the village.

A large proportion of subtropical trees and plants ascend to a short distance above Keadom. These are succeeded by a dense shrubby vegetation of *Hydrangea*, *Rosa macrophylla*, and *R. sericea*, *Prinsepia utilis*, *Pyrus*, *Pieris ovalifolia* and *P. formosa*, *Zanthoxylum*, *Rhododendron arboreum*, *R. ciliatum*, and maples, &c. Other plants are *Leycesteria formosa*, *Buddleia macrostachya* and *B. Colvillei*, *Berberis* and *Rubus niveus*, with palatable fruits. *Roscoea alpina*, the box-like

Sarcococca pruniformis, are in great quantity. The handsome fern *Osmunda claytoniana* overruns large areas in the manner of bracken at lower elevations. Two species of *Leucostegia*, *L. Hookeri* and *L. membranulosa*, with sweetly hay scented foliage, and a large stipitate form of *Pleopeltis simplex*, grow in a wood at about 8,000 feet. *Goniophlebium ebenipes* was in dense clusters on the tops of many of the numerous rocks.

This locality is eminently distinguished by its variety of coniferous trees. *Abies webbiana*, the dominant species on the humid mountains of the Singalelah and Chola Ranges, even here maintains its supremacy in numbers. It ranges from 9 to 13,000 feet. Up to 11,000 feet it grows intermingled with the other lighter foliaged pines, but from that elevation to its highest limit, it exists alone or associated with the equally dark coloured *Juniperus Pseudo-Sabina*, so that nothing breaks the monotony of their sombre aspect on the slopes which they clothe with their lofty forest. *Juniperus Pseudo-Sabina* and *J. recurva* are the two last representatives of arboreal vegetation, both attaining 15,000 feet, the former as a small, stunted, weather-worn tree, the latter, a prostrate intricately branched shrub. Large quantities of planks cut exclusively from *Abies webbiana* are annually exported to Tibet. Their preparation is an important industry of the inhabitants of Lachung, who shape the timber with no other appliances than the axe and wedge.

Picea Morinda and *Tsuga brunoniana* are found between 8,000 and 11,000 feet. The first is a tall conical tree with thick trunk and dark green pendulous branches, the latter has spreading branches, drooping at the extremities, and bears very small cones. *Larix Griffithii*, the only Himalayan Larch is restricted in its distribution to Eastern Nepal, Sikkim, and Bhutan, and previous to its rediscovery by Dr. Hooker, its existence was only known from a notice in Griffith's journals. It is pyramidal in outline, and attains a height of 60 feet. The branches are long and pendulous, supporting erect cylindrical cones closely resembling those of *Picea Morinda*. It first appears at 8,000 feet, becomes plentiful at 9,500 feet, and ascends to 12,000 feet. It is the only deciduous conifer in Sikkim, the leaves falling in autumn, to be renewed in the beginning of the following summer.

The Peach and Apricot introduced from Tibet are cultivated by the villagers at Lachung, but in no great quantity. I was informed that the fruits of both ripen in the end of September. *Pyrus sikkimensis*, a wild crab-apple tree, is common, but its austere fruit is only pleasantly edible when stewed with sugar. A little barley is reared, with radishes and turnips, which were the only vegetables I could obtain worth eating; their scanty yield of potatoes consisted of wretchedly small tubers, so waxy as to be nauseating when cooked.

The Tankra Mountain was within easy distance of Lachung, and as it promised a quick introduction to the Alpine Flora I was anxious to see, I determined to visit it at once. We crossed the Lachung river, threaded our way through the narrow dirty lanes of the village, and immediately climbed up the grassy slope above it. For about a mile the path runs through a dense herbaceous vegetation composed of the plants I formerly enumerated at Lachung. A beautiful small pink lily, *Lilium roseum*, grew profusely on banks, associated with *Roscoea alpina* and *Drosera peltata*. At 9,500 feet we passed through a fine grove of small trees of rhododendrons, maples, roses, *Lindera neesiana*, *Betula utilis*, and the laurel-like *Daphniphyllum himalayense*. In a mossy hollow within this wood I found a large quantity of the delicate little fern, *Polypodium trichomanoides*. *Goniophlebium subamœnum* depends from the trunks of silver fir and *Goniophlebium erythrocarpum*, another epiphytic fern, accompanies arboreal vegetation to the end. Passing the grove we entered the magnificent forest of pines which extends without a break to 12,500 feet. We marched to its upper skirts, where we camped after clearing a sufficiently large plot of ground near a stream, winding through an expanse of rhododendrons. Two species of *Cremanthodium*, *Polygonum vaccinifolium*, *Oxyria digyna*, *Pedicularis* of various species, *Potentilla fruticosa*, beautiful yellow and white *Saxifragæ*, Epilobiums, *Lactuca macrantha*, *Parnassia*, and aconites were the commonest plants observed.

The following day we held on our course upwards. The region of trees was soon left in the rear, and a low growth of *Rhododendron companulatum* succeeded, showing the dark glaucous tints of its unfolding leaves. The bladder headed *Saussurea* (*S. obvallata*) thrives on the damp margins of watercourses, and bumble bees were busy amongst its fœtid flower heads. These are in clusters of a dark brown colour, enclosed in inflated white papery bracts forming an ovate head, and yielding sufficiently to allow insects to insinuate themselves with ease. The woolly headed *Saussurea* (*S. gossypiphora*), delighting to grow in sandy debris, appeared at first sight to be only a ball of white fleecy wool. The flower heads when young are completely enveloped, but on the approach of maturity a ring opens on the top, disclosing the inflorescence inside. Another remarkable plant, in similar situations, is *Crepis glomerata*, whose carrot-like stem buried in the ground is flattened on a level with its surface, and bears a broad head of yellow flowers, surrounded by small radiating leaves pressed closely to the soil. *Rheum nobile* is visible on the faces of all the cliffs around, and ascends to 17,000 feet.

Our third day's camp was pitched below the ascent to Kanko La, which passes at the gorge, cut by the river through a low line of cliffs, forming a barrier across the head of the Tankra Choo valley.

The next day we crossed this by the frequented path, and followed the track to the Tankra Pass, which is at an elevation of 16,000 feet. The terminal valley slopes gently to the pass, is exceedingly rocky, and is bounded by snowy ridges, and much snow lay in its hollows. The rounded surface of the pass is a conglomeration of sand and boulders, which are constantly sliding down from the crags on either side.

On the Tibetan side a narrow grassed valley descends steeply. Fog effectually prevented a more extended view. Between the Kankola and the barren glacier below Tankra La there was a multitude of bright hued flowering plants. Brown and yellow *Chrysosplenium*, yellow *Saxifragæ*, blue and yellow forms of *Corydalis*, a few species of *Pedicularis*, beautiful small primroses—*Primula uniflora*, *P. muscoides* and *P. soldanelloides*, *Ligularia*, *Rheum nobile*, some blue gentians, and the bladder headed *Saussurea*, were the most notable. The plants I found on the pass are those enumerated by Dr. Hooker. In addition to his list, I may state that *Meconopsis horridula*, a lovely plant, affecting only the most inclement situations, was collected in full bloom from under the shelter of rocks. I stayed for two hours at the pass in the vain hope of the fog lifting to give me a better view. During this time the continuous winds were most variable, and the variability was rendered more obvious by the methods vapour was deposited by different currents. The wind which blew from the Tankra Valley on the south-west brought hail and snow, that from the south-east in Tibet precipitated rain. The same meteorological conditions prevailed during Dr. Hooker's visit. The Tankra La is south of the summit of Tankra mountain, to the east is a long rocky ridge cleft by the minor pass of Kanko La, and between this and the culminating peaks is a large shallow basin with undulating surface, through which flow the head waters of the Tankra river. Those on the north spring from many points under snow fields, that on the south-east rises below the pass and is immediately lost in the great central moraine, reappearing at its lower end as a large and swiftly flowing torrent. It is joined near the Kanko La by the united streams from Tankra; after effecting the junction the river turns sharply to the west through the deep and narrow defile of the pass, and hastens precipitately downwards for some miles until it debouches in the Lachung river a little south of the village of that name. From the Kanko spur to the limit of pines at 13,000 feet the valley is broad and shallow; here it suddenly narrows and remains so to its termination. During the week I spent on this excursion, the weather was uniformly boisterous and wet, while those of my party who remained below at Lachung asserted that they had enjoyed calm sunny days and clear nights.

The fragrant spikenard, *Nardostachys Jatamansi*, is plentiful on Tankra, and the scrophularineous plant, *Picrorhiza Kurrooa*, intensely bitter when chewed, is abundant about 14,000 feet, and is held in much repute as a febrifuge and tonic. The only woody plant above 15,000 feet is the humble *Diplarche pauciflora*.

I returned to Lachung, where I halted for a week to dry the numerous specimens collected during the excursion to Tankra La, and also to make preparations for a journey to the Donkia Pass at the head of the Lachung valley, and the most northern point I could reach in Sikkim.

We started on the 13th August, and arrived at Yeumtong the same day. The path runs close to the west bank of the Lachung river the whole distance. About half way we crossed an enormous landslip, which had partly buried a large forest of *Abies webbiana* and larch.

The interesting feature of this day's journey was the extensive pine woods through which we travelled. On the western slopes they were scattered, on the east they grew down to the verge of the stream, and every tree was festooned with the long gray streamers of the Lichen, *Usnea barbata*. I was told that, when reduced to great straits, the Tibetans made use of this unpromising plant as food; when boiled it was said to be gelatinous and palatable, and as nourishing and life sustaining as beef.

We saw many tailless rats, but I was prevented from procuring specimens by my desire to respect the superstitious notions of the Tibetans and Lepchas regarding it. I was told, with every appearance of truth on the part of my informants, that the killing of one of these animals was certain to be followed by storms of snow or rain, according to the season of the year, and many instances of personal experience were related to me in corroboration of the fact. The Tibetans are also reminded of the near approach of winter when they observe these rats busy themselves in preparing their winter quarters.

The valley is wide as far as Yakcha; it then narrows for a considerable distance, broadening into large swampy flats, intersected with streams towards Yeumtong. The spurs on the western flank are precipitous, rocky, and sterile, supporting vegetation only at their sheltered bases, but forests clothe the opposite side with verdure. Every mountain mass in this region facing a southerly direction in the least degree is, in summer, exposed to the full force of the damp southerly winds, laden with mist, which blow with increasing violence as the day advances, to die away only at night. These continuous currents rapidly disintegrate the surface, washing down the superincumbent earth, and wearing away rocks which become precipices or crags of fantastic shapes. Vegetation, therefore, cannot find permanent foothold under such circumstances, and its abundance is confined to the sheltered flanks, where a copious rainfall is absorbed by the deep and fertile soil.

The increase of 3,000 feet in elevation between Lachung village and Yeumtong causes the appearance of many new plants along the route. Composites become more numerous and gregarious. *Inula Hookeri* beautifies dry knolls with its densely leafy stems and large heads of yellow flowers. *Erigeron multiradiatus*, species of *Senecio*, *Anaphalis*, and *Aster* are equally plentiful. Various *Thalictra* and *Halenia elliptica*, all with blue and white flowers, grow in the grass and low thickets. Orchids are well represented by *Habenaria*, *Satyrium*, and the small purple *Orchis Chusua*, allied to the common *O. latifolia* of England. The monkshood was flowering and attained a height of 6 feet in flat grassy fields. Cattle and horses are allowed to graze at large in places infested with this plant, but sheep and goats do not possess the same instinctive knowledge of its poisonous properties, and great care has to be exercised by the shepherds when driving them through these localities.

Myricaria germanica, *Allium*, *Meconopsis simplicifolia*, whose spikes, 3 feet in height, greatly excel the stunted specimens seen on Singalelah, the large wild Rose, *Rosa macrophylla*, with bright red fruits, and shrubby *Berberis*, were all common.

The following day was Sunday, so I halted at Yeumtong. The tents were pitched between the huts and the river, which flows tranquilly in a broad shallow bed down the whole length of the flat. Opposite is the snowy mountain with a glacier reaching a lower level than any other in Sikkim, as Dr. Hooker mentions; a thick turf of grass covered the surface of the flat. A yellow Anemone, *A. obtusiloba*, with leaves appressed to the ground, a surculose *Saxifraga*, the Dandelion, *Taraxacum officinale*, the aromatic yellow *Elsholtzia eriostachya*, and groups of brilliantly yellow flowered *Senecio diversifolius* gave colour to the scene. A small swamp north of the camping ground was brightened by the yellow flowers of *Pedicularis tubiflora* and a small floating *Ranunculus*, and beyond, in a small wood of silver fir, I found many specimens of *Meconopsis simplicifolia* and *M. nepalensis* in fruit. I collected a large supply of seed from the former, but nearly every capsule of the latter had been destroyed by a small white caterpillar. Both species never grow in the open, but prefer the shelter afforded by rocks or small bushes on the skirts of thickets. The commonest plant was *Cnicus eriophoroides*, with strongly spinose leaves, which penetrate the thickest cloth, and cause a smarting sensation in the skin. Other plants were *Salvia glutinosa*, *Lychnis nutans*, *Cucabalus baccifer*, and *Asarum himalaicum*.

Aroids of the genus *Arisæma* are common. In early summer their tuberous roots are prepared and used for food according to the method described by Dr. Hooker. I was presented with a few glutinous cakes, made in the most approved style, but the taste was so peculiarly disagreeable that I could not persuade myself to eat more than one mouthful.

Yeumtong is a large cattle grazing station and depôt for Tibetan exports and imports. Communication thus far from the lower valleys is kept open by the people of Lachung, who carry loads of planks, bamboo, rice, dye-stuffs, such as the leaves of *Symplocos* and the roots of *Rubia cordifolia*, which are transported by yaks to Tibet. In exchange the Tibetans bring down loads of salt, barley, blankets, and other commodities for the inhabitants of Lower Sikkim. I could not ascertain how may yak loads of merchandise are carried annually over the Donkia Pass, but every day during my stay in this part I saw herds of at least 10 or 12 yaks, and often many more, either going or returning. Looking northwards from Yeumtong, the slope of the valley to an elevation of 13,000 feet is easy, and is black with pine forests. Above, the land is red and sterile. On the west a tributary stream flows from behind Changokhang along the base of a long declivity of sand. The view higher up is cut off by jutting spurs below Momay Samdong.

The following morning we marched to Momay Samdong, elevation 15,300 feet. The first and the last two miles of the path are easy, but the intervening portion is steep. A forest of silver fir, maples, birch, *Pyrus*, rhododendrons, and others extends to 13,000 feet; for a few hundred feet further some scattered black Juniper trees occur; an equal distance is occupied by rhododendrons and willows, and passing the spurs which terminated the view from Yeumtong, the valley is broad, with enormous rocks on its surface, and the surrounding hills are rocky. I have nothing to add to the excellent description of this spot by Dr. Hooker, but a place with more inhospitable surroundings can scarcely be imagined. A few yaks were grazing, the sole survivors of large herds almost annihilated by an epidemic of rinderpest which raged during the previous year.

This great calamity had impoverished the inhabitants of the valley, as for the greater part of the year they depend for sustenance on the curds and cheese made from the milk yielded by their flocks.

As the morning of the 10th August was bright and sunny, holding out hopes of a fine day, a promise unfortunately not fulfilled, I set out for the Donkia Pass, seven miles, from Momay, and the most northerly point I could reach in Sikkim. The tracks lead through a waste of stupendous rocks, and the stream becomes divided into many channels. The hills rising arounded are masses of rock and rubble, forming a most forbidding landscape in the aggregate. The shallow waters support an abundance of reddish *Sedum* and *Rheum nobile.* Myriads of blue gentians unfolded in the brief glimpse of sunshine we enjoyed, and *Allardia glabra* grew in low dense tufts, bearing large sessile flowers with yellow disks and purple rays. The musk-scented *Delphinium glaciale* ascends to 17,500 feet, accompanied by *Aconitum Napellus,* reduced in size to a small plant with two or three leaves, bearing but one short pedicelled flower. Other plants were *Ranunculus lætus*, *Cyananthus* of two species, the edelweiss (*Leontopodium alpinum*), *Erigeron*, *Cremanthodium reniforme*, *Lactuca dubyæa*, *Crepis glomerata*, *Saussurea*, and the curious lichen-like *Antennaria muscoides*. *Rhododendron nivale* and *Ephedra vulgaris* were the only woody plants. The feature of the vegetation from 17,000 feet upwards is the prevalence of plants growing in dense hard hemispheric tufts, such as *Arenaria*, *Saxifraga*, *Saussurea*, *Astragalus*, and *Myosotis Hookeri*. The last steep ascent to the pass, 18,100 feet elevation, is devoid of vegetation. The view across Cholamoo to the Kambajong mountains was clear, and we were able to appreciate fully the graphic account of this wonderful region which Dr. Hooker gives in such perfect detail.

My orders forbade my crossing the Donkia, so I returned to Momay in the evening through a blinding storm of snow and rain.

As I was anxious to penetrate to the Lachen valley through the Sebo La, I waited at Momay for a week in order to obtain good weather for the attempt, but the cold south wind drove a thick mist and drizzling rain without intermission, and I was compelled to relinquish the idea. One day I went eastwards to the great glacier of Kinchinjhow. Passing the hot springs noted by Dr. Hooker, and climbing to the crest of the terminal moraine, we walked along the top of a lateral one leading far into the snowy billowy mass of the glacier. I was surprised to find many plants flourishing in such a bleak place *Eriophyton himalaicum* was common. It is a white woolly Labiate with bright blue flowers peeping from under the leaves; I have never observed it but on dry sandy slopes. The other plants were a minute *Saxifraga* with extensive runners, a small gentian, *Pedicularis* of three species, *Festuca*, and *Carex*. *Rhododendron nivale* was dead and withered, having probably been killed by the severity of the previous winter, but, strange to say, *Potentilla fruticosa*, in its largest and most developed form, and not the creeping variety we should expect to find here, was covered with flowers and foliage, and was as much at home amongst ice and snow as it is at the more temperate elevation of 10,000 feet. From Momay Samdong I returned to Yeumtong, and halted there a few days. I ascended to the glacier on the opposite side, which Dr. Hooker failed to reach through the gorge. Nowadays there is a cattle track leading to the high pastures, so that progress is easy. *Rosa sericea* is the commonest shrub in the pine forest and *Salix wallichiana*, *Pyrus microphylla* are all abundant. Between the summit of the first ridge and the glacier the path runs along the side of the stream; the rest of the area is too encumbered with boulders to be walked on with safety. Above 13,000 feet the forest of silver fir is replaced by penetrable rhododendrons, and a few stunted trees of black juniper. There is little variety in the herbaceous vegetation, the biting air radiating from the glacier being too chilly to suit even cold loving plants. *Podophyllum Emodi* with red fruits eaten by the Tibetans, *Swertia Hookeri*, *Rheum acuminatum*, and *Cnicus eriophoroides*, were conspicuous by their abundance and size.

The weather at Yeumtong was also uniformly wet and miserable, so I started for Lachung on the 20th August, arriving the same day. I stayed to dry my collections and to make arrangements for an excursion through the Sebu valley to Ghora La, a part as yet unvisited by any naturalist to my knowledge.

In his "Himalayan Journals" Dr. Hooker notes "about five miles "above Lachung the valley forks, the eastern valley leads to lofty "snowed regions, and is said to be impractible." A lofty precipice at the immediate entrance to this valley, and on its northern flank, attracted my attention. On inquiry, I discovered that one of my men had ascended to Ghora La, the first pass from the northern end of the longitudinal range which extends from Donkia to Gipmoochi, and forms the eastern boundary of Sikkim. From a distance the forbidding aspect of this valley would naturally lead one to conclude that to explore it would be a matter of great difficulty and danger. It is almost useless to interrogate the Tibetans as to the feasibility or otherwise of ascending any comparatively unfrequented valley, as their jealous exclusiveness prompts them to overrate natural difficulties in the hope of deterring Europeans and other strangers from exploring the various practicable routes to Tibet. The path to Ghora La runs up the valley of the Sebu river, a large and turbulent stream. I was informed that this valley is held in considerable veneration by the Tibetans on account of the lofty and unique precipice guarding its entrance, for the sacred mountain of

Donkia at its head, and also for the sacred inscriptions which were carved on the face of a cliff half way up the ascent to Ghora La; but this last feature is now completely obliterated, as the whole face of the rock has fallen down. At the summit of the pass, and visible from a considerable distance, is an irregular pillar-like rock, which I was told is the figure of a god, but its real character was apparent on closer inspection.

Leaving Lachung on the morning of the 3rd September, I took the following route. The Lachung valley path is taken for three miles to the village of Yakcha. Here the track to Ghora La breaks off abruptly to the north-west, a direction which is pursued more or less the whole way. A short walk through a forest, containing beautiful Conifers, *Picea Morinda*, *Tsuga brunoniana*, *Larix Griffithii*, brought us to the Lachung, which is crossed by a good wooden bridge. On the other side is a steep for a short distance, and afterwards the path runs almost level over somewhat swampy ground. The River Sebu, which, from its source downwards, is a swiftly flowing torrent coursing through a boulder strewn channel, here becomes broader, shallower, and more tranquil. Small willow trees fringe its banks, with *Euonymus* and *Ilex intricata*, while Thalictrums are specially abundant. Beyond a sudden ascent is made along the base of a stony precipice with *Woodsia lanosa* growing in its clefts, and a little further on I found its allied species *Woodsia elongata*, the only occasion I recollect of their association, as the former affects a more alpine elevation as a rule. The remainder of the day's march is steep, through a large forest of silver fir, until we arrive at the first convenient camping ground, a cattle station named Sebu, artificially formed by a clearance in the forest. Here *Ainsliæa pteropoda*, *Heracleum*, and *Galeopsis Tetrahit* monopolised spots untrodden by cattle.

The northern side of the valley is enclosed by a continuous precipitous spur, broken in one place only by a deep forest clad depression. At the foot of the chief one at the commencement of the valley is a small temple, where services are held on certain days of the year. The range on the other side being more gently sloped, is covered with forest and succeeding smaller vegetation, and is more diversified by ravines.

Of treees which do not extend above 10,500 feet in this valley, are *Picea Morinda*, *Tsuga brunoniana*, *Larix Griffithii*, *Prunus Padus*, *Pyrus lanatus*, *Pyrus sikkimensis*, *Hydrangea*, *Ilex dipyrena*. Above this elevation to 13,000 feet is a continuous forest of *Abies webbiana* maples, birch, viburnum, *Berberis*, and rhododendron; *Aconitum Napellus* grows luxuriantly on the grazing ground at Sebu.

At 11,000 feet large trees of *Juniperus recurvus* appear, and at 13,000 feet (the upper limit of *Abies webbiana*), and for a short distance above it, they form the only arboreal vegetation.

From 13,000 to 15,000 feet there is an impenetrable growth of rhododendrons and willows, with numerous small trees of *Pyrus foliolosa* and *P. microphylla*, and intermingled with grass. Underneath these bushes is an equal luxuriance of herbs, such as aconites, species of *Senecio*, *Saxifraga*, *Primula*, *Potentilla*, *Polygonum* and Thistles. *Cnicus eriophoroides*, which is moderately common in most valleys, is so abundant here as to be a perfect pest.

From Sebu (12,500 feet) the next march was to a yak grazing station named Sethang, at an elevation of about 15,000 feet. Up to 14,000 feet the floor of the valley is very steep, but about 1,000 feet below the level of Sethang we emerged on a swampy flat, through which the Sebu flows in several channels. Its surface is covered with grass, and its borders are cumbured with *Rhodendron Anthopogon.* A tributary from the west pours over the hollow of a precipice in a magnificent waterfall. Above the plain is a steep rocky barrier thrown transversely across the valley. On reaching its summit we arrived at the camping ground. The coolies took up their quarters in the deserted huts, and my tent was pitched near an accumulation of enormous boulders. A small muddy pond lies at the upper end of the flat.

Here the two branches of the river Sebu unite, one rising in Donkia, the other in the nameless snowy mass south of Ghora La. The former is seen flowing in a deep and narrow gorge; the latter rushes down a steep rocky transverse slope similar to that which we ascended below Sethang. Both run parallel to each other, and are probably the terminal moraines of the glacier, which is now confined to the head of the valley. *Rhododendron companulatum* is the common shrub. *Primula Stuartii, Meconopsis nepalensis, Geranium collinum,* all in fruit, abound on the flat.

On the following morning I walked to Ghora La, elevation 17,000 feet. The path descended into the stream from the Donkia, the ascent beyond winds amongst gigantic boulders on the western side of the slope. At the top is another small plain, and the remaining portion of the valley becomes broader and ascends by a long easy gradient to 16,500 feet.

From this onwards to near the head of the valley is bounded with uneven ridges and unbroken slopes, which are possibly the lateral moraines of the ancient glacier terminating below Sethang.

Both seemed to be elevated 500 feet above the river. A broad terrace runs along the base of the eastern one for some distance. Higher up the valley expands and the stream again divides. The eye, following the course of the western branch, is carried to the snowy mountain of Forked Donkia, from whose feet a glacier spreads out over a large area.

There is an accumulation of rocks and sand at the eastern termination of the glacier, and its waters feed a lake white with suspended silt. This mountain is an object of worship and veneration, and votive offerings of prayer, printed cloths, fluttered on the banks of the lake. Between Forked Donkia and the pass is a shivered line of crags devoid of snow; the pass itself is an extremely narow gap, with sheer rocks rising sharply on either side. Its final ascent is occupied by a glacier which widens out eastwards into an enormous field of ice under another snowy mountain. The actual ascent of the pass is commenced at a small pool at the end of the glacier. There is no permanent path amongst the shifting mass of rocks, so we had to make our way as best we could up the lateral moraine of loosely poised boulders. Half way up we took advantage of a small snowfield. The last hundred yards was over the glassy surface of the ice, in which we cut steps as we advanced.

The available standing room on the pass would scarcely suffice for 10 men, and the descent on the Tibetan side is startling in its steepness. Its surface was covered with a shoot of stones. This pass is not practicable for the passage of yaks, and is seldom used by foot travellers. On the north a high naked hill projected eastwards, appearing as a huge pile of stony debris; on the south a large glacier descended. Below lay the broad open grassed valley of the Ridu Chu; beyond were a few isolated rounded peaks surrounding elevated plateaux of large extent, and further back still were mountains of the same dull red colour running east and west, and over them hung heavy masses of clouds which obscured more distant views. The lower part of a snowy mountain, said to be Chumulhari, was seen in the far east.

The district we overlooked is called Kamboo. Medicinal hot springs of great repute occur in it. Phari is to the south-east of Ghora La, but it is hidden behind intervening ranges.

The vegetation above 15,000 feet in the Sebu valley is very scanty. *Sedum* of two or three species, *Saxifraga*, *Allardia*, *Meconopsis horridula*, *Cyananthus*, *Gentiana*, *Saussurea* of three species, *Ephedra*, *Rhododendron nivale*, and a few other plants, principally grasses and sedges, form the bulk of the vegetation. *Rheum nobile* grows on the surrounding otherwise sterile heights, and attains an elevation of 17,000 feet.

We found a woolly *Saussurea* (*S. tridactyla*) at the foot of the ascent to the pass, but from thence upwards not even a lichen was visible. This *Saussurea* and *Antennaria muscoides* are supposed by the Tibetans to be the most esteemed of their gods as incense. The plants used in temples are *Rhododendron Anthopogon* and *R. setosum* and juniper. I could not obtain definite information as to the derivation of the name "Ghora." I was first told that the sacred pictures carved near it suggested its name, and I concluded that the name was a contracted form of Gorucknath; afterwards it was explained that the meaning was "winding," in allusion to the winding route to the pass.

Yaks are grazed from 14,000 up to 17,000 feet in this valley during the summer, and at Sebu there was a large herd of cattle.

From Sethang I returned to Lachung in two marches, arriving on the 8th September.

The time until the 14th was devoted to arranging and packing our collections and luggage. We returned to Tumloong by the Teesta valley path, and arrived there on the 20th September.

Third Tour. The Chola Range.—I left Tumloong on the 22nd September for my third and last excursion. The first march was to Rungpo, elevation 6,000 feet, a halting stage of the Sikkim Rajas during their journeys to and from the Chumbi valley, their favourite summer resort. The path descends through cultivated fields to the beds of two arms of the Ryott river, which join a little further down. They are crossed by cane suspension bridges. The succeeding ascent is steep through many fields of dry ground rice and millet. An edible variety of Job's tears (*Coix Lachryma*) is grown near watercourses. The whole valley is thickly populated, and the inhabitants practice a careful system of cultivation.

An Oak, *Quercus semecarpifolia*, is common at Rungpo, but the rest of the vegitation is of the usual type at this elevation.

Onwards to Chola Pass the marches are made eastwards up a continuously steep ridge. The second day's journey brought us to Laghep (10,400 feet), a small cattle station with a camping ground on a projecting knoll covered thickly with *Iris nepalensis*. This locality is celebrated for its variety of rhododendrons, every species existing in Sikkim, excepting *R. nivale*, being found within a distance of two days' short marches. It was too early in the season to obtain seeds, as they do not ripen until November.

The plants of *Decaisnea insignis* which Dr. Hooker observed at 7,000 feet still grow abundantly there.

The next day's march was a short one to Pheyeuggong, 12,400 feet, a large flat topped peak, where *Abies webbiana* is first seen. Beyond Pheunggong we descended to the Rutto river, where we found quantities of *Cathcartia villosa* in fruit. This plant is extremely local in its distribution, being found only in this small valley and in one small area near the summit of Lingtu. The ascent continues along the broad valley of Rutto, which becomes bleak upwards. *Abies webbiana*, however, attains an elevation of 12,600 feet at Chamanako, where we halted.

The first part of the ascent to Chola Pass is very steep, an easy path then leads to the next ridge, beyond which is a small and pretty lake. A second slight ascent brought us to another small lake, and a pond lies immediately beneath the pass. The summit of the pass is rounded, and its surroundings are barren rocks. On the Tibetan side a narrow gorge like valley descends sharply. Snow had fallen the previous night, descending to 13,000 feet. We left Chamanako on the 28th, and resumed our journey along the Chola range. The path follows the course of the Rutto for half a mile, then crosses it, and an ascent to 14,000 feet follows, through a scrub of rhododendrons. At 14,000 feet there is a large hollow covered with rhododendrons, containing two lakes, the larger ovoid in shape, the smaller is long and narrow. Attaining the ridge beyond, we descended to the River Rungpo, passing through on the way a narrow defile walled with rock. Another ascent through small rhododendrons again follows, after which we descend, and strike a path from Guntok. We walked along this for a mile, and reached the camping ground named Buthan, a large expanse of green turf closed in on the east by a barrier-like cliff.

During this march we found specimens of *Chrysanthemum Atkinsoni*, the only example of the genus occuring in Sikkim, some small Saussureas with fern like leaves, primroses, *Parnassia*, the bladder headed *Saussurea*, *Senecio amplexicaulis*, and the small rhubarb *Rheum acuminatum*.

The following day we marched to Kapup, a small plateau under Zeylap La. We ascended to the top of the rocky barrier east of the camp. From here we obtained a magnificent view of a long trough-like valley terminated by a ridge beyond Kapup. The whole scene was of a warm brown colour from the herbaceous vegetation, killed by the late autumn frosts. This valley, which runs southwards, is bounded on the north by the main Chola ridge forming the political boundary between Sikkim and Tibet. There was a long gradual descent down this remarkable valley, in which are two marshy lakes of considerable extent. Beyond the second lake a deep narrow gorge intervenes. This is clothed with pine forest, and at the end of the valley the meeting of two opposite spurs held back the stream to form a large lake reflecting the pine woods on its dark tinted surface. Surmounting the ascent from the stream, we emerged on the grassy flat of Kapup with a few scattered silver fir trees, small rhododendrons, and shrubby *Berberis* in its sheltered parts. The spikenard, *Nardostachys Jatamansi* was common, but few plants grew in the closely cropped herbage.

On the 30th September I walked to the pass, and returned through Kapup to Gnatong. No vegetation exists at the pass itself, and that below it was fast withering. At Gnatong the plants still in flower were *Onosma*, *Senecio*, and various *Saussurea*, *Swertia*, and *Saxifraga*. From Gnatong I travelled by the military road to the Teesta bridge, arriving at Mongpoo on the 5th October.

During the whole of this excursion I had only one fine day, namely, the 28th September; a dense fog with drizzling rain prevailed the rest of the time, to my disappointment, as it prevented me from noting the details of the scenery I passed through.

Sir Joseph Hooker to Royal Gardens, Kew.

The Camp, Sunningdale,
My dear Dyer, October 29, 1893.

I am very glad to see Mr. Gammie's "Botanical Tour in Sikkim" reproduced in the *Kew Bulletin*, a mark of appreciation which its interests and value well merit. The perusal of it strengthens in me the opinion which I have long entertained, but which I have never formulated, that Sikkim, for its area, presents one of the richest, if not the richest, botanical regions on the globe. And further, that though no more than about 40 miles from east to west, and 100 from north to south, and situated beyond the northern tropic, I believe that, when all that is known of its vegetation shall have been brought together, it will prove to be a better microcosm of the flora of the globe than any other area of equal or even of much larger dimensions.

Thus, in its alpine region, the floras of the European, Siberian, Chinese, and American mountains are all richly represented, and there also are found the principal types of the steppe and desert vegetations of Tibet and Central Asia. In its temperate region European genera abound in species in greater numbers than they do further west in the Himalaya, or probably than they do further east in the same range, where different climatic features prevail; and in the same region types of Chinese, Japanese, and North American (both eastern and western) genera appear in force, and which rapidly disappear in advancing toward the Western Himalaya. Lastly in the tropical region, the Malayan flora disputes precedence with those of the plains and lower hills of the Indian continent, Burma and Ceylon, as represented by genera and species, many of which are also characteristic of tropical Africa. In short, with the exception of the prevalent types of the Australian, South African, and South American floras, there are few others that do not meet the eye of the wanderer in Sikkim.

In respect of the temperate and alpine floras of Sikkim, Mr. Gammie's indefatigable exertions and fruitful observations have put all this before the naturalist's eye with remarkable lucidity, and added largely to our knowledge of this province of the Indian Empire.

Ever affectionately,
(Signed) Jos. D. Hooker.

The Director,
Royal Gardens, Kew.

CCCXXXVII.—POLING IN AGAVE PLANTS.

The progress of the fibre industry in the Bahamas has been fully noticed during the last four years in the pages of the *Kew Bulletin*. At the present time the earlier plantations are approaching maturity, and it is anticipated by those interested in the subject that the export of fibre on a commercial scale will probably begin next year.

In the meantime a question of some importance has arisen in regard to the duration of life of the particular sort of *Agave* cultivated for fibre purposes in the Bahamas.

This is botanically known as *Agave rigida*, var. *sisalana*. It is a dark green, smooth-leaved sort (with no marginal teeth) originally introduced, either directly or indirectly, from Yucatan. There it is known under the aboriginal name of Yaxci.

The plant more generally cultivated for fibre in Yucatan is a glaucous-leaved sort, armed with small, black, marginal teeth (*Agave rigida*, var. *elongata*), known locally as Sacqui. The Bahamas plant, the Yaxci, is still also found in Yucatan, but apparently it is not specially selected for general cultivation.

Of *Agave* plants, a familiar example, grown in green-houses in this country, and sometimes put out for decorative purposes during the summer months on lawns and terraces, is that commonly called the American aloe (*Agave americana*). Such plants produce nothing but leaves for the greater part of their life. In this state they may last for many years. In some species there are also occasionally produced root suckers, which afford a ready means of increasing the plant. This, however, is a purely vegetative reproduction. The exact life-period of Agaves in northern latitudes may vary from 10 to, possibly, 50 years or more. On account of this exceptional longevity amongst succulent plants they are sometimes called Century plants. In the tropics, grown under natural conditions, these plants seldom last longer than seven to 12 or 15 years. Sooner or later, however, within the periods above mentioned, and depending on the conditions under which they are placed, they throw up a "pole" or flowering stem. On this will successively appear the flowers, the capsules bearing seed, and possibly also numerous bulbils. In some species there are produced abundant seeds, but no bulbils; in others there are produced bulbils only and no seed. The ripening of the seed or production of bulbils, whichever may be the normal habit, brings the life of the plant to a close. After this the whole plant withers and dies

The question raised in the Bahamas, and respecting which the aid of Kew has been sought, has reference to the exact length of time the Yaxci (*Agave rigida*, var. *sisalana*) may be expected to last in the leaf state. In other words, how long can the plant be made available to the planter for the production of fibre? The matter is naturally one of great interest to the Bahamas people, for on it hangs the success of their plantations. The result of the inquiry at Kew is given in the following correspondence. It is so far satisfactory that, with care and judgment on the part of those directly in charge of the plantations, there need be no greater cause of anxiety in the Bahamas than has been felt during the last 30 years in Yucatan, for plants that have poled might easily be replaced from time to time by strong healthy "supplies" from nurseries, and the work of the plantations need not at any time be seriously interrupted.

Mr. NEVILLE CHAMBERLAIN to ROYAL GARDENS, KEW.

Memorandum.

July 26, 1893.

Information has been received from the Bahamas of a somewhat serious nature in reference to the Sisal industry. It will be remembered that in the wild state these plants pole when about seven years old, but it was supposed that the cutting of their leaves when cultivated would delay the poling and prolong the life of the plant, as is said to be the case with the Yucatan variety. It is said, however, from observation of old plants in the Bahamas, that cutting makes no difference to the life of the plants, which seldom exceeds seven years. As four years at least are needed for the growth of the plants before they are fit for cutting, this only leaves between two and three years of cropping, in which the planter must recover all the capital expended in their cultivation. Any suggestions by which the life of the plants might be prolonged and poling prevented are invited, as the early poling will gravely affect the success of the industry.

N. C.

THE MONROE FIBRE CO., LIMITED, to ROYAL GARDENS, KEW.

DEAR SIR, Abaco, Bahamas, July 20, 1893.

THE interest shewn by your department in the fibre industry of this Colony, and the valuable information you have already afforded in connexion with the plant, have prompted me to submit the following questions, which deal with points of prime importance to those engaged in its cultivation. In fact I do not know to whom else to apply, for our plant is undoubtedly different from that commonly grown in Yucatan, and no one in the Bahamas seems able to speak with certainty upon the subject under review.

Our plant, or "Bahamas Hemp" as it is now termed, is an Agave with dark green leaves, which are spineless except for a thorn at the tip. From all accounts it is identical with the "Yaxci" of Mexico.

1. The life of the "Sacqui," which is that generally grown in Yucatan, is said to be from eight to 16 years after cutting has been begun. Can you tell me whether our variety enjoys as long a life or not?

2. Do Agaves put out during their life a certain fixed number of leaves, the normal quantity varying but little between plants of the same species, or is there no regular limitation in this respect?

3. If the output of leaves on a plant is variable, would cutting them as they mature be likely to increase it, and, judging from analogy or otherwise, ought the cutting to be made several times a year or at any particular seasons? Also, would cutting the leaves have the effect of prolonging the life of the plant by retarding its poling?

It may seem strange to ask for such information when we have the plant here growing under our eyes, but it is only now reaching the cutting stage on most of the plantations, and where it has been longer established there unfortunately does not seem to have been much observation bestowed upon its nature or the circumstances of its growth.

You can easily perceive the necessity we are under of obtaining a clear understanding on the points raised in this letter, as, for instance, when it will be advisable to reset the fields with young plants so as to be ready to take the place of the old ones as the latter die off, and also how to prolong the life and increase the yield as much as possible. I need not say how thankfully any assistance you may kindly give in this direction will be received.

Yours very obediently,
(Signed) J. GURDON.

The Director,
Royal Gardens, Kew.

ROYAL GARDENS, KEW, to MR. AUSTEN CHAMBERLAIN, M.P.

Royal Gardens, Kew.
August 18, 1893.

DEAR MR. CHAMBERLAIN,

WHEN your brother was last at Kew he left with me a memorandum respecting the age at which plants of the Yaxci of Yucatan, now known as the "Bahamas Pita" or Sisal, reach their maturity. He also asked whether anything could be done by processes of cultivation to retard the poling or the appearance of the flowering panicle, which, it is well known, marks the duration of the life of the plant.

2. There is apparently very little reliable information obtainable in regard to the age at which these plants flower. In fact in the whole of the literature of the subject the references are very few and the language is vague and inconclusive. In the enclosed memorandum I have given a brief summary of what has been recently published, and it may be possible to draw some general conclusions from the facts therein stated.

3. The observations in regard to the Sacqui of Yucatan do not, it is true, bear directly upon the subject. But as the Yaxci or Bahamas Pita is only a variety of the same species it is improbable it should differ in any marked degree from that plant. The length of time that elapses previous to flowering in Agave plants may in some degree be affected by soil and climate, but as a general process of growth and with plants cultivated normally over a large area the experience in Yucatan may not be far from what will ultimately obtain in the Bahamas.

4. The latest information from Yucatan is furnished by Mr. Pierce, the Vice-Consul at Merida. He states that "a Hemp plantation in "Yucatan lasts for some 15 years." This is not conclusive as regards the age of the individual plants. It merely shows that while some of the original plants may pole at one age and some at another, their places are so filled up from time to time by new plants that the whole undertaking receives no serious check up to about the fifteenth year.

5. It appears to be recognised in Yucatan as the result of experience (without apparently any reference to the determining causes) that poling is encouraged amongst these plants if the leaves are left uncut for any length of time after they have arrived at maturity. There is little or no scientific basis for this opinion, and experience at the Bahamas should be carefully recorded if tending in that direction.

6. They also believe in Yucatan that if the root-suckers which are abundantly thrown out around the base are allowed to remain attached for a long period they tend to exhaust the parent plant and accelerate the period of poling. Such suckers no doubt divert the strength of the parent plant, and if allowed to remain too long either of two things must happen—the parent plant will produce fewer and smaller leaves or its period of maturity will be hastened. The practical outcome of this is the suggestion that such suckers as are necessary for supplying the plantation should be removed when large enough into nurseries and all others not required should be removed periodically and thrown away.

7. Mr. Stoddart, it is noticed, records that the Yucatan people are very particular when cutting the leaves to cut them as close as possible to the stem of the plant. In other words, they consider it undesirable to leave any portion of the base of the leaf to form what is called in tree-pruning a "snag" on the parent plant. A certain degree of "snag" is inevitable. This, however, afterwards falls off, when dry, leaving the central stem of the plant eventually quite clean. I am not prepared to attach much importance to this matter in relation to poling. It is undesirable as a matter of economy in fibre, and it may also have some effect on the general health of the plant. It certainly would produce an untidy appearance in the up-keep of the plantation, and altogether the practice of close cutting the leaves should be systematically carried out.

8. Coming now to the Sisal plant as known in Florida and the Bahamas, it is evident that an impression prevails both in Florida and the Bahamas that some of these plants have flowered at about the

seventh year after planting. The instances recorded are given in the accompanying memorandum. They are, however, not conclusive. The exact history of the suckers before they were put out, and the treatment they afterwards received in regard to cutting the leaves and allowing the suckers to remain on indefinitely, are not given. All these are important factors to be considered before an opinion can be formed. The result of further and wider experience will probably show that some plants may pole at seven years, others at a later period. It is unlikely, if properly treated, that they will all pole over a large plantation at the same time. If the plantation is carefully watched, and fresh plants are put in immediately the fact is realised, or at the first sign of poling, there need be little interference with the work of the plantation.

9. It is essential that fresh plants in large numbers be grown on in nurseries with the view of supplying any vacancies caused by poling. Also the pole should be cut out as soon as it appears above the leaves in order that the leaves already formed should be ripened before the plant dies. This practically means that the plant would be kept available for yielding fibre for nearly a year later than it otherwise would be.

10. There is another point to be briefly noticed. While it is important that all the mature leaves be cut when they have attained full development, great care should be taken that the immature leaves are not also cut. The regular cutting of the fully matured leaves might possibly tend, as mentioned above, to prolong the vegetative life of the plant and retard poling. Theoretically, however, there is no ground for such a supposition. On the other hand the cutting of immature leaves would certainly have a contrary effect. The plant would be likely to be weakened by the process, and the subsequent leaves borne by it would be smaller and weaker. The exact period when the leaves are to be cut should be carefully studied. As a general rule the leaves are ripening when they are gradually falling from the erect into the horizontal position on the plant. Also there may be some indication in the colour of the leaves. These are, however, matters to be decided on the spot by careful and skilful people. It is only necessary here to draw attention to them, and to state that both the life of the plants and the quality of the fibre, in other words, the success of the whole undertaking, may not improbably depend upon them.

I am, &c.
(Signed) D. Morris.

J. Austen Chamberlain, Esq., M.P.,
40, Prince's Gardens, S.W.

MEMORANDUM.

The Life of Sisal Hemp Plants.

There are numerous species of Agave (popularly called Aloes) belonging to the natural order *Amaryllideæ*. They are almost all monocarpic perennials. That is, they grow on for a number of years producing leaves only; finally they flower, and this they do but once in their life, and that period is apparently determined by the nature of their environment. Usually Agaves under cultivation in this country live to a great age. On this account they are sometimes called century plants. In their native country they live for seven to 15 years. When once the monocarpic species have flowered and produced seeds or bulbils (pole plants) they die. The following notes refer to the Sacqui (*Agave rigida* var. *elongata*) and to the Yaxci or Bahamas Pita (*Agave rigida* var. *sisalana*) :—

(*a.*) Mr. Stoddart says, "the plant (the Sacqui of Yucatan) lasts " . . . for at least 25 years in a cutting state, depending on the soil " and treatment." To renew a plantation after the original plants have become exhausted, "it is usual to plant at proper distances, by the sides " of the old plants or between them, young shoots which three years " afterwards (and upon the failure of the old ones) will be fit for cutting." A new field will thus "be kept up without any loss of time or suspension of work." (Sisal Hemp, its adaptation to Jamaica, p. 4.)

(*b.*) Mr. Stoddart describes the poling as follows: "This happens when the plant has arrived at cutting age *and the plants are not cut.*" . . . "When the pole begins to come out and gains a length of about " three or four feet, it is customary to cut it off close without injuring " the leaves. These leaves will then mature and be fit to be taken off " before the plant dies." (l.c. p. 7.)

(*c.*) Poling appears to be accelerated (1) by the leaves not being cut when they have arrived at maturity, (2) by the plants being exhausted by numerous suckers allowed to remain around their base, (3) by careless cutting of the leaves. Stoddart, on this latter point, says: "If the " stump (or base) of the leaf be left of any length on the trunk it " seriously injures the plant, spoils its vigour, and *makes its existence a* " *short one.*" (l.c. p. 7.)

(*d.*) Mr. Pierce says: "A hemp plantation in Yucatan lasts for some " 15 years . . . on good land the crop commences in four years " or earlier, whilst on rocky ground from six years or more." (F. O. Report, 1892, p. 2.)

(*e.*) Mr. Dodge, discussing the Pita or Yaxci plant of Florida and Bahamas, remarks that in one instance, on very poor soil, he noticed that "a long row of plants set out 10 years ago to form a boundary " line had hardly made any growth." (Report of C. R. Dodge on "Fibre Investigation in the United States." Washington, 1893, p. 21.)

Mr. C. T. McCarty of Ankona, Florida, says: "With us *Agave sisa-* " *lana* sends up its pole at seven years on our best lands. . . . So " far as the plant is concerned the 'poor land' theory has no foundation " in this locality. Our strongest and finest plants are on our best land." (Dodge, l.c p. 15.)

(*f.*) Mr. Merrick Shaw, Polk County, Florida, describes a Sisal Hemp plant under his observation as follows: "The original plant growing on " the soil, of which a sample was sent, poled at seven years old. Twenty " layers of leaves had been cut from this plant, and the lowest of those " remaining measured 5 feet 9 inches in length by 5 inches in width at " the broadest part. About 100 suckers had been removed from (the " base of) this plant and planted elsewhere." (Dodge, l.c. p. 17.)

(*g.*) Mr. Dodge figures and describes a plant with leaves barely a foot " long, which had thrown up a slender pole to a height of 8 feet or " more." He adds: "I was informed by residents on Indian Key " that this premature blossoming of a young plant or sucker *while* " *yet attached to the parent root* is not of uncommon occurrence." (Dodge, l.c. p. 18.)

Kew, 16 August 1893. D. M.

[*Note added.*—The plant cultivated in Mauritius, and yielding what is known as Mauritius Hemp is the Green or Fœtid Aloe (*Furcræa gigantea*). The value of the exports are about 50,000*l.* annually. This plant is similar to an *Agave*, both in appearance and habit, and it also produces numerous bulbils or pole-plants after flowering. The experience in Mauritius with regard to poling of the *Furcræa* has a striking resemblance to what has been observed in regard to the Agave in Yucatan. M. de Chazal, who has written an account of "*Le fibre d'Aloës*" (Mauritius, 1882) states (p. 21) "that " the plants generally pole at the age of seven or eight years; they can, " therefore, be cut four or five times before poling and before it is " necessary to replace them." On the same subject Mr. John Horne, F.L.S., late Director of Gardens and Forests in Mauritius, writes under date of 4th September 1893, as follows: "The life of *Furcræa gigantea* " in Mauritius is from seven to 10 years . . . as many of the plants " flower three to four years earlier than others, the leaves of the seedlings " (or pole-plants) from these are fit for cutting when the late flowering " plants are dying out, so cutting once begun on a plantation may be said " to be continuous. . . . . Supplying amongst old plants should be " done in time so that as the old ones die out cutting from the young ones " should begin. Over-cutting the leaves is common in Mauritius. This " is generally held to be injurious to the plants, weakening their growth " and causing them to flower and die prematurely. People in Mauritius " say that by cutting only the mature leaves the growth of the plants is " not weakened, and thus large fine leaves are obtained, yielding long fibre " of the finest quality. But I have never heard the idea expressed that " such a manner of cutting prolonged the life of the plant beyond what " I might call the natural limits. It is said in Mauritius that over-cutting " weakens the plants and causes them to flower and die prematurely, so " it may be also said in Yucatan that cutting only the mature leaves pro" longs the life of the plants to its natural limits. It comes to this, that " what is said not to shorten the life of the plants in Mauritius is said to " lengthen it in Yucatan—a case of arriving at the same place from " opposite directions."]

CCCXXXVIII.—COFFEE CULTIVATION IN THE NEW WORLD.

In the year 1874–75 Ceylon exported 988,328 cwts. of coffee, or a little under one million cwts. In the year 1892 the total exports were only 43,143 cwts., or less than one-twentieth of the exports of 1874–75. In fact, it may be said that the splendid coffee industry of Ceylon has within the last 20 years almost ceased to exist. This, as is well known, has happened owing to the appearance of a deadly fungoid disease amongst the coffee plants, rendering them incapable of producing remunerative crops. This disease (*Hemileia vastatrix*) is known as the "Ceylon coffee-leaf disease." It has extended its ravages into nearly every coffee producing country in the Old World. It first of all spread from Ceylon to Southern India and then gradually extended itself to the rich coffee plantations of Java, to Sumatra, the Straits Settlements, Mauritius, Natal, Madagascar, and last of all to Fiji. The effects of the disease have been almost as deadly in other countries as in Ceylon. Hence in the Old World tropics coffee cultivation is carried on under very disadvantageous circumstances, and the total yield is comparatively small. Fortunately, the disease has not, as yet, appeared in any portion of tropical America, either in the West India Islands, in Central America or tropical South America. The falling off in the production of coffee in the Old World has naturally produced a stimulating effect upon coffee cultivation in the New World. Prices have ruled high and the industry has, on the whole, proved of a very remunerative character. The important coffee industries in Guatemala, Costa Rica, and Brazil have greatly contributed to keep up the supplies in the world's markets, and as might naturally be expected they have in consequence become singularly prosperous. In Guatemala especially the exports during the last few years have nearly doubled, and they are now of the annual value of nearly three millions sterling.

Attention was called to coffee production in Guatemala in the *Kew Bulletin* for November last (1892, p. 23). It was then sought to call into existence a similar industry in the rich lands of the adjoining Colony of British Honduras. Everything necessary for such an industry could be made available in British Honduras, and the fact that one estate has already been established there, shows that the soil and climate are favourable to the production of excellent coffee. It is probable that before long sufficient capital and enterprise will be forthcoming to bring to this British Colony some of the prosperity which is now so much in evidence within a few miles over its frontiers. Jamaica is an old coffee-producing country, and some of its produce from the Blue Mountains ranks as nearly the best in the world. Of late years, however, there has been little or no increase in the exports of Jamaica coffee. In fact what change has taken place has been for the worse and not for the better. In 1882 the exports (according to the *Handbook of Jamaica*) were 41,004 cwts.; in 1892 they had fallen to 25,677 cwts. There are yearly fluctuations depending upon seasons and prices, but the general tendency lately, in spite of good prices, has been towards a smaller production of Jamaica coffee. At a first glance this may have been attributable to a gradual exhaustion of the present estates and to a want of suitable land for opening up new estates. It is true that some of the old estates are becoming less productive than formerly, but there are still excellent tracts of land suitable for coffee cultivation in Jamaica, and these only require to be rendered accessible by railways and roads to support a considerable industry. As may be gathered from the correspondence below, it appears that not only are no new coffee plantations opened in suitable lands in Jamaica, but the labour that might be employed upon them is being attracted from the island for service on the coffee plantations of Guatemala.

The forest lands still remaining in the interior of Jamaica require to be carefully protected in certain localities, but after all reasonable precaution is taken in the interest of forest conservation there is room for numerous flourishing coffee estates in the island, and now, when so much is done in other countries in the New World in regard to coffee cultivation, it would be singular if little or nothing were done in British Colonies possessing equal, or, in some cases superior, advantages.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, July 15, 1893.

I AM desired by Mr. Thiselton-Dyer to inform you that the remarkable development of the coffee industry in the Republic of

Guatemala was noticed in the *Kew Bulletin* for November last, and attention was directed to the very favourable prospects which the cultivation of coffee offered to suitable men in the adjoining Colony of British Honduras.

2. In a Report just issued by the Foreign Office (No. 1245 Annual Series, 1893), there are further interesting facts given in regard to coffee cultivation in Guatemala, and these concern very intimately the important Colony of Jamaica.

3. It appears that an effort has been made to supply the deficiency of labour in Guatemala by importing free Coolies from Jamaica. The Report states that "a comparatively small number of coolies have been "brought from Jamaica by an American firm of coffee planters, and are "found to do extremely well. This is the first time foreign labour has "been managed with success, and may indicate the direction in which "to look for a possible solution of the problem."

4. These coolies are time-expired immigrants whose movements cannot be controlled by the Jamaica Government. They have, however, cost the community large sums of money, and after having been brought all the way from India and taught plantation work it is a disheartening circumstance that they should be attracted out of the Island.

5. This is all the more to be regretted as there are at the present time thousands of acres of valuable land in Jamaica as well adapted for coffee cultivation as any portions of Guatemala. In a lecture delivered before the Institute of Jamaica on the 17th May, 1881, with the late Hon. Alan Ker, Senior Puisne Judge, in the chair, I stated:—"With "regard to amount of land still available in the Island for coffee cultivation, reports from Manchester and St. Ann show that there are "thousands of acres of good coffee lands at elevations between 2,000 "and 2,500 feet in the Mile Gully mountains, and on through Clarendon "and St. Ann, which might be very advantageously brought under "cultivation. In the Blue Mountains districts and on the southern "slopes there are not many tracts unopened, but on the northern "slopes there are extensive areas finer and richer than any now "cultivated lying in the upper portions of the valleys of the Rio Grande, "Swift and Spanish Rivers. These tracts are estimated at from 60,000 "to 100,000 acres and consist almost entirely of untouched virgin "forest."

6. These lands require to be opened up by railways and roads, and as regards the former a good deal has already been done by the enterprise of the Jamaica Government in that direction. If the Government could see its way to open roads from the railways into some of the lands above mentioned and offer them for sale after making their existence thoroughly well known in the United States and in Europe, it is probable that successful new coffee plantations could be established in Jamaica worked by the labour which is just now being attracted elsewhere.

7. In spite of the great difficulties experienced in Guatemala with regard to labour, it is noticed that the production of coffee has risen from 49 million pounds in 1888, to 75 million pounds in 1892. Of the latter quantity more than eight million pounds, of the value of 322,000*l*., have been received in the United Kingdom. These facts are of considerable importance to Jamaica, and Mr. Thiselton-Dyer is of opinion that the Government of that island would do well at the present time to encourage in every possible way the development of so important an industry. It is one well understood amongst all classes of the community and thoroughly adapted to the soil and climate of districts

that only require to be made accessible to render them the richest of any in the Colony.

I have, &c.
(Signed) D. Morris,
Assistant Director.

Edward Wingfield, Esq., C.B.,
Colonial Office, S.W.

Foreign Office Report. Annual Series, 1893, No. 1245, Guatemala.

(Extracts.)

On some plantations, to meet these increasing difficulties, South Sea Islanders have been imported, but owing to difference of climate, food, language, and perhaps more especially because their employers have no experience in dealing with these people, the venture has not proved successful.

On the other hand, a comparatively small number of coolies have been brought from Jamaica by an American firm of coffee planters, and are found to do extremely well. This is the first time foreign labour has been managed with success, and may indicate the direction in which to look for a possible solution of the problem . . . .

The growth of the coffee industry during the last 5 years has been as follows, viz.:—

Table H.

Year.	Crop.	Excess over previous year.	Value.
	lbs.	lbs.	£
1888 - -	48,743,024	203,757	2,003,734
1889 - -	51,571,939	2,828,919	2,119,162
1890 - -	51,973,414	401,475	2,135,743
1891 - -	52,197,853	224,439	2,185,397
1892 - -	74,652,985	22,455,132	2,714,644

Note.—These values are calculated at the rate of 4*l.* to the quintal of 100 lbs. on board.

The apparently small increase in value (529,247*l.*) as compared with the increase in production (22,455,132 lbs.) in the crop of 1892 is due principally to the depreciation in the value of the dollar.

The exportation of coffee has been as follows, viz.:—

Table I.

Country.	Quantity.	Value.
	lbs.	£
Germany - - - -	23,075,027	923,001
United States - - - -	16,843,903	663,756
England - - - -	8,049,724	321,988
France - - - -	3,305,975	132,239
Austria - - - -	303,953	12,158
South America - - -	179,933	7,197
Italy - - - - -	43,030	1,721

The total number of coffee trees now standing is estimated to be 64,186,924, there being this year an increase of 25,138,994.

Messrs. LEWIS and PEAT to ROYAL GARDENS, KEW.

6, Mincing Lane, London, E.C.,
August 28, 1893.

DEAR SIR,

IN reply to yours of 31st ultimo, we give you for what they are worth the following remarks on coffee.

After a period of comparatively low prices, the value of this product rose rapidly about six years ago, since when prices of the finer grades (plantation sorts) have remained fairly steady. We look upon the position of this particular kind of coffee, which is that which a European planter would aim at producing, as a strong one, the supplies from both Ceylon and East India having fallen off (in the former case they have almost entirely ceased), and their place being only very imperfectly filled by the finer coffees from Costa Rica, Guatemala, &c., especially Vera Paz and New Grenada. Among the British Colonies the West India Islands, or some of them, Trinidad, Dominica, and Jamaica, offer perhaps the best field for the cultivation of this product, the very serious drawback being possibly the difficulty in obtaining an adequate supply of labour. Fortunately the requirements in this respect are not so great with coffee as with some other products, as after the ground has once been cleared and planted the trees have only to be kept clean, pruned, and manured, when they will last for many years, giving, after the fifth year, their yearly crop of fruit, varying in quantity and quality according to the season and to the care bestowed on them. The number of hands required is, of course, much larger during crop time than during the rest of the year, but a good deal of the picking, &c. is done in many parts by women and children.

The machinery required for preparing the bean for market is not expensive, especially when there is sufficient water power available to work it, and no drying power beyond that of the sun is required for drying the produce. The climate in the higher parts of Jamaica is very pleasant, and suitable for Europeans to live in, and we understand that in the centre of the island there are large districts in which land very well suited to the cultivation of coffee may be obtained, though there is, we believe, this disadvantage, that *heavy* crops are not obtained in the very highest altitudes more than about once in three years. The difficulty, as we have said before, may be the securing a sufficient amount of reliable labour, but this is a difficulty common, we think, to almost every part of the globe, and, at the present time, to all industries. If this can be surmounted, as we doubt not it can be to a sufficient extent, with care and energy, we should consider that a young Englishman, with some knowledge of outdoor work, and with an inclination towards a planter's life, would have the prospect of a good future before him in coffee planting, supposing always that he is possessed of sufficient capital to buy, clear, and plant his land, and to keep his estate going for the four or five years before payable crops can be harvested, without having to borrow for the purpose at a heavy rate of interest.

The statistical position you have doubtless already before you. Notwithstanding the increased crops from Brazil during the past few years as compared with the previous production from that place, there has been little or no accumulation of stock at the consuming centres of the world, while dealers in the finest descriptions find frequently considerable difficulty in satisfying their requirements.

Always at your service,

We are, &c.

(Signed) LEWIS AND PEAT.

D. Morris, Esq., C.M.G.,
Royal Gardens, Kew.

CCCXXXIX.—RESOURCES OF BRITISH HONDURAS.

A very exhaustive Report on the present condition of the Colony of British Honduras, prepared by the Governor, His Excellency Sir Alfred Moloney, K.C.M.G., has recently been issued by the Colonial Office (*Colonial Office Reports:* Annual, No. 73, 1993). From this Report the following general survey of the resources of the Colony will prove of interest not only in this country, but in many portions of Her Majesty's Possessions.

The commercial prosperity of colonies which depend on a limited number of articles of export is liable to disastrous fluctuations. Striking instances are to be found in the ruin of a once extensive trade, that had been confined to a single commodity, from competition and the inevitable fall in price, from the ravages of rats or locusts, or from a single blight. So far British Honduras would seem to have stood exceptionally in the Colonial Empire in having for the past two centuries relied almost entirely upon its forest produce and on its rivers as means of transport to the sea. Some of our West African Possessions have stood somewhat similarly since palm oil succeeded the slave export trade; that industry is now seriously threatened by animal fats and other sufficiently available and equally suitable commodities. One of the extracts from coal tar practically killed the once flourishing and profitable cochineal trade, and also affected the indigo trade of India. Beet has contributed to the depression of the sugar trade. The substitution of iron for wood in shipbuilding, particularly in men-of-war, at one time almost killed the large timber export trade of the Gambia and West Africa. These are again attracting attention for their mahogany, cedar, rosewood, dye and other woods; and the marked and progressive revival of the trade, and the dimensions it is assuming must naturally be a subject of direct concern and anxiety to all wood-cutting centres.

Mahogany and logwood trees have been for several generations the principal articles of commerce in British Honduras, but they are said to be getting more and more difficult of access and consequently more expensive to work and get to the market. The value of these industries is not for one moment questioned. On the contrary, it is highly desirable to promote them and to protect the forests on which they depend. The Colony's motto, "Sub umbra flores," should have now a more extended application.

In view, however, of such experiences as have been referred to, it has been generally accepted that even in commerce it is a hazardous experiment to "carry all your eggs in one basket."

As guides in establishing profitable industries we must look to the source of supply, the prospects and disposal of growth, and the area of the field of demand. It has now become a generally accepted policy in the Colonies to encourage the production of varied staple articles of export of a more or less permanent character. Much has been done in this direction by the active interest and assistance of the authorities of the Royal Gardens at Kew to develop new industries and to distribute plants of commercial importance. With this object there have been established in all our West Indian Possessions Botanic Stations. A similar institution has been established as a tentative measure in Belize, the capital of this Colony, which has such exceptional advantages whether we look to climate, soil, or a market. It has with some justice been advanced that British Honduras can be made the tropical garden of North America, and it may be remembered that 28° North is generally accepted as the frost line, which may be said to mark the limit northwards within which the growth of economic products in demand can be profitably undertaken.

FERTILITY OF SOIL.

As to fertility of soil, what more convincing proof can be advanced than the facts that in the sugar areas to the north and south of the Colony cane has been known to "ratoon" from 20 to 30 years, and that in the rich and naturally fertilised valley beds, bananas have maintained themselves without degeneration for 10 to 12 years, if not longer.

PRODUCTS.

The products of cultural industries, still really in their infancy, are chiefly bananas, plantains, cocoanuts, coffee, henequen, Indian corn, limes, mangoes, sour and sweet oranges, pineapples, avocado pears, rubber, to which there should be added in time annatto, cacao, coir, ground-nut, indigo, jute, pita, ramie, spices, vanilla and doubtless other promising marketable commodities.

To the small extent to which the banana has been successful to the north of the frost line referred to, where it will always be a precarious crop at best, it has proved inferior in quality to the West Indian and Central American fruit. Whilst in 1879 it did not appear among our records its export was represented by 72,436 bunches in 1891.

The plantain is a staple of food over a large section of Negroland in West Africa. The descendants of its interesting people to the north of the Gulf of Mexico represent a consuming power of probably 9,000,000. Tons of this fruit from Cuba and elsewhere meet with a ready sale in Florida. This Colony's shipments to New Orleans rose from 50,000 plantains in 1879 to 1,580,200 in 1891.

CACAO.

The home of the cacao is in tropical America. One or more valuable species may belong to British Honduras and include that which is said to be the best in a marketable sense. Notwithstanding, it may be said to be here remarkable for its absence from the export cultures of the Colony which have grown in value, in round numbers, from $12,000 in 1879 to $296,665 in 1891. Yet, in the island of Grenada, of the West Indies, and but 5° to 6° to our south, and with an area of 133 square miles and an estimated population in 1889 of 50,000, cacao has developed into its main export, which reached in 1890 a value of 228,319*l*.

GROUND-NUT AND VANILLA.

The clover-like ground-nut, so desirable as a pasture where the bread-nut is not available, apart from its valuable oil-yielding seed, and henequen would seem to be admirably suited for growth in the pine ridges, as would also the Ceara rubber. That interesting orchid, the vanilla, whose home is also in Central America, is one of the most valuable products and has, near at hand, a rich and ever-growing market. Its cured pod sometimes fetches as much as 30*s*. per lb. It is a plant easily propagated by means of cuttings, and has developed into a considerable export from Vera Cruz.

COFFEE.

Our Guatemalan neighbours seem to turn no small attention to the cultivation of the Arabian coffee. Whilst it will doubtless prove suitable to the high areas of the Colony, the introduction of the hardy and rich Liberian coffee—so well suited to low-lying areas, with its comparatively heavier crop, averaging from 6 lbs. to 8 lbs. per tree, 400 of which can be accommodated on each acre—should receive the consideration it deserves. Judging from the experts from the Malay Peninsula, and the imports to the United States, there is a promising field of demand offered in the direction of the latter for the growth of Liberian coffee and of such commodities as jute and other fibres, indigo, ginger, and spices generally.

COHUNE OIL.

The Cohune oil industry remains yet dormant, if I except the use for domestic and cooking purposes to which it is put among the families of mahogany and logwood cutters. Two-fifths of the Colony, viz., 1,933,762 acres, are, it is estimated, under this graceful native "Prince of Wales" palm. If we allow 25 trees to the acre, a very low average, and 1,000 nuts as the annual yield per tree, and accept that 100 nuts yield a quart of oil, this dormant industry, if awakened to full activity, would yield 276,537 tons of oil at a price per ton appreciably above that which obtains for cocoanut oil, to which it is superior.

PINE PRODUCTS.

Then, again, apart from its resinous property, which was turned, I understand, to profitable account some years back, the native pine is estimated to cover a third of the Colony, or, 1,613,136 acres, and to average 100 trees per acre on our great southern pine-ridge. Its wood is said to almost equal that of the yellow pine of the United States, which, in the beginning of 1888, was reported to have been nearly worked out and might, in part, have to be replaced by the local pine. The growth on the older pine-ridges of the Colony may, when opened up, prove of sufficient age and diameter to make it worth while to have attention turned to adding this timber to our exports, as can doubtless be done with many other valuable woods as yet unknown.

COCOA-NUTS AND HENEQUEN.

The coral patches and marine islets we know as "Cays," that fringe to the eastward the waters of this Colony, offer a condition of site exceptionally favourable for the growth of henequen and the cocoanut tree, described as the most tender of palms as regards frost, the friend of tropical agriculturists. The area of such Cays is given approximately as 112,527 acres, which might be turned to much more profitable uses and yield than obtain at present. With even a quarter of such acreage suitable for the culture of such products as cocoanuts and henequen, it could be covered with plantations of the former numbering 2,813,200 trees with an annual yield of at least 100 nuts (a low average) aggregating 281,320,000, worth, at the current rate per thousand, 1,406,600*l.*, I might explain that such an aggregate of nuts on the basis of 1 lb. from 7 nuts or 14 per cent. fibre, should yield 18,000 tons of fibre that would realise in the London markets from 30*l.* to 10*l.* per ton, according as it is suited for brushes, mats, or stuffing.

The annual export from the Colony of cocoanuts during the past five years has averaged in number 1,651,933, and in value $32,505.

SAPODILLA AND PIMENTO.

That delicious fruit, the sapodilla, if picked green, will stand shipment; the tree abounds in this Colony, and apart from its valuable and durable wood, yields an extract which contributes mainly to the manufacture of what is advertised and so widely used in the United States as "chewing gum."

Then, again, trees yielding the pimento of commerce abound in a wild and unappreciated state, yet this spice was exported from Jamaica to the value of 81,326*l.* in the year 1890-1.

CCCXL.—THE PRIETO FIBRE EXTRACTING MACHINE.

In Captain Jerome Stuart's report on the fibre industry of Yucatan, reproduced in the *Kew Bulletin*, 1892, p. 272, mention was made of certain machines that were being tried for the purpose of extracting fibre from the leaves of the Sisal Hemp plant or Henequen. An account of one of these machines, known as the Weicher Fibre Extracting Machine, now on trial in this country, was given in the *Kew Bulletin* for June last (1893, p. 141). Another machine mentioned was the Prieto machine. Of this Captain Jerome Stuart gave the following brief particulars:—"The Prieto machine is manufactured by Puig and "Negre, Barcelona, Spain. It requires 16-horse power engine and "the services of two men and a boy. Capacity, 7,000 pounds "of dry fibre per day of 10 hours. Cost, 4,500 dollars." As the value of a machine depends so entirely on its capacity, it was desirable to obtain more precise information on this point. In the following letter received from the makers of this machine, it will be noticed that they claim that the machine will clean 100,000 leaves, and turn out from 5,833 to 5,960 pounds of dry fibre per day. These estimates of capacity prove how untrustworthy any figures must be that are not based on actual trial. In fact, it is impossible to attach any value whatever to such figures unless they are checked by some one having a thorough knowledge of the subject and perfectly unbiassed in his judgment:—

[Translation.]

Señor ROMAN ROMANO to ROYAL GARDENS, KEW.

Calle Fontanella 10, Barcelona,
12th November 1892.

DEAR SIR,

Messrs. PUIG AND NEGRE have sent us the printed report by Captain E. Jerome Stuart, of the Bahamas, as well as your favour of the 2nd instant.

These gentlemen were the first makers of our machines for extracting fibre of Sisal and Henequen, but afterwards we set up in this city our works for making them, having already sent about 40 machines, "Prieto Hermanos" system, to the State of Merida de Yucatan (Mexico), where they are working perfectly with favourable results for the farmers who purchased them.

We have no photographs or drawings to send to you, but we forward an account of the work it does compared to the old grating wheels, power required, and price of the machine here for cash.

Hoping that this information will be useful to you for the Henequen plantations in the Bahamas,

I remain, &c.
(for Romano Noriega y Preto)
Roman Romano.

D. Morris, Esq., F.L.S.

Comparative Statement of the difference between 12 of the present Scraping Wheels (Raspadoras) and the La Vencedora Machine, system "Prieto Hermanos."

People employed in 10 *hours' work.*

La Vencedora.	12 *Raspadoras.*
1 for the feeder.	20 scrapers (men).
2 ,, carrying leaves.	7 carriers of leaves.
1 ,, receiving the fibre.	
2 ,, carrying it to drying room.	4 people to carry to drying room.
2 ,, collecting the waste.	7 ,, to collect waste.
8 total people employed.	38 total people employed.

The difference in favour of the La Vencedora machine is therefore 30 men.

Production of Fibre.

La Vencedora.	12 *Raspadoras.*
100,000 leaves scraped in the machine give from 230 to 235 arrobas (5,833 to 5,960 lbs.).	100,000 leaves scraped in 12 raspadoras give from 165 to 170 arrobas (4,185 to 4,311 lbs.).

Difference in favour of the La Vencedora machine equals 65 arrobas (1,648 lbs.) increase per day. Cash price for machine in Barcelona, 4,500 Spanish dollars (928*l.* 2*s.* 6*d.*). Power, 12 to 16 horse power (steam). Water is not required to wash the leaves. Total weight of the machine, 9,500 kilogrammes (9 tons 7 cwts.).

(Signed) Roman Romano,
Barcelona.

CCCXLI.—ARROWROOT.

Arrowroot is a name properly confined to the starch extracted from the rhizomes of *Maranta arundinacea*, a plant indigenous to the West Indies. It is said to have first been discovered in Dominica, hence sent to Barbados, and subsequently to Jamaica. Arrowroot is said to have first been introduced into England in 1732, but the first actual consignment in quantity is put as late as 1799.

St. Vincent Arrowroot had for many years a high reputation, which of late it has somewhat lost. A full account of its preparation is given in the *Kew Bulletin* for August of the present year (pp. 191–204).

Arrowroot from Granada has lately come into the market, and some particulars on the subject are given below.

Inquiries were addressed to Kew as long ago as 1878 on the subject of Arrowroot in Queensland.

Its production from *Maranta arundinacea* seems to have presented some difficulties, and those of *Tous les mois* (also originally a West Indian product) from *Canna edulis* seems to have taken its place. This, if not identical with Arrowroot, has its own merits. Some information on the subject is given below.

South Sea Arrowroot is the produce of *Tacca pinnatifida* (*Kew Bulletin*, 1882, p. 51), plants of which flowered at Kew in 1891, and were figured in the *Botanical Magazine* (tabb. 7299, 7300). In the letter-press Sir Joseph Hooker gives an interesting historical discussion of the discovery of the plant and its uses.

QUEENSLAND.

Mr. H. L. Thompson in "Pharmaceutical Journal," October 22, 1892.

The Arrowroot Plantations of Coomera and Pimpama, Queensland.

The arrowroot grown in this district is the purple variety, the *Canna edulis*. It sometimes grows to a height of eight feet, bears a pretty scarlet flower, and a dark purple seed-pod follows, which is generally sterile. The best variety of arrowroot, the *Maranta arundincea*, which is grown so extensively in the Bermudas, thrives well in this district; but its cultivation has been almost abandoned, owing to the difficulty of manufacture. This kind attains the height of two feet, and bears, at maturity, a small white flower somewhat resembling the potato blossom. In the districts of Coomera and Pimpana there are from 250 to 300 acres under cultivation.

Mr. George E. Moore to Royal Gardens, Kew.

1, Jeffrey's Square, St. Mary's Axe, E.C.,
June 17, 1893.

Dear Sir,

By the mail the following inquiry was made in reference to a sample of Queensland arrowroot which I sent to St. Vincent to a correspondent to show him what was being done:—"Obliged to you "for sample of arrowroot. Is this *Tacca pinnatifida* or South Sea "arrowroot? I am very interested to obtain the latter." Can you answer this question for me? I enclose a small sample of Queensland arrowroot which please do not trouble to return.

I also enclose a copy of a letter, with editor's note, that appeared in a trade journal which appears to answer my question, if you consider the explanation therein given correct. It is certainly correct that "Tous les mois" when imported from the West Indies as that, does [not] fetch so high price as their arrowroot.

I am, &c.
(Signed) GEO. E. MOORE.

Extract from "PRODUCE MARKETS REVIEW," 10th June 1893.

DEAR SIR,

THE *Brisbane Courier* of April 15 contains a paragraph copied from your journal (no date given) derogatory to Queensland arrowroot. The quotation concludes, "It is much inferior in point of "strength and glutinous properties as compared with St. Vincent "arrowroot."

Being the manufacturers and shippers of this parcel under notice, we challenge this assertion, and are quite prepared to submit our production to a public test in competition with the other makes named.

That there is a slight difference we admit, ours being made from a different plant, viz., *Canna edulis;* but when prepared as directed cannot be distinguished. Certainly the slight difference in texture does not warrant the extreme prejudice that seems to exist in certain quarters against Queensland production.

We remain, &c.
Pimpama, April 21. F. LAHEY & SONS.

[Arrowroot was originally only prepared from the root of *Maranta arundinacea.* The term has since by common commercial usage been extended to similar starches extracted from other plants, though Dr. Hassall, in his work on adulteration, thinks the practice undesirable. The starch of the *Canna edulis* was known to commerce as "Tous les mois," and did not fetch nearly so much as St. Vincent or Natal arrowroot. Messrs. Lahey's produce is evidently from its better colour an improved preparation from *Canna edulis*, but the price it fetched at public sale is the best guide as compared with St. Vincent and Natal. No doubt the *Maranta* could be readily grown in Queensland as the *Canna*, and these preferences for particular tints of colour or strength of gluten are, more or less, a matter of habit, and possibly not very reliable. The preparation is quite a legitimate one in every way, and it is a question for Messrs. Lahey whether the price is satisfactory, but if not they might try other plants. If called "*Canna*" arrowroot, there could be no misconception, and it might in time attract a special connexion of its own.—Editor, *P. M. P.*]

MESSRS. LOW, SONS, & BEDFORD to ROYAL GARDENS, KEW.

11, Billiter Square, London, E.C.,
December 13, 1893.

DEAR SIR,

HAVING noticed your name in one of the trade journals in connexion with an article on arrowroot, we have taken the liberty of sending you a sample of the Queensland product (*Canna edulis*) prepared by our friends, Messrs. F. Lahey & Sons, of Pimpama, Queensland, who are doing all they possibly can to improve their production and bring it to perfection. They have recently planted another sort of arrowroot, the *Maranta arundinacea*, a shipment of which we expect to arrive in this country very shortly.

If you could favour us with any information especially as to modes and machinery in use in other places, the same would be esteemed.

Yours faithfully,
Low, Sons, & Bedford.

W. T. Thiselton-Dyer, Esq.,
Royal Gardens, Kew.

GRENADA.

Curator, Botanical Station, Grenada, to Royal Gardens, Kew.

Botanical Station, Grenada,
June 15, 1893.

Dear Sir,

I send by this mail two samples of arrowroot prepared by Mr. Minors, of Bacolet Estate in this Island.

It is quite a new industry here, and Mr. Minors is most energetic in trying to make it a success. He is also very anxious to find out if the sample dried by artificial heat comes up to the standard of good quality, and has asked me to forward them to you, and solicit your kind assistance in obtaining a report on them.

I am, &c.
(Signed) G. W. Smith.

D. Morris, Esq., F.L.S.,
Royal Gardens, Kew.

Messrs. W. and D. Harvest to Royal Gardens, Kew.

Dowgate Dock, Upper Thames Street,
London, E.C., July 3, 1893.

Dear Sir,

I am in receipt of yours of the 30th ultimo, with accompanying samples Grenada arrowroot. I have carefully examined these with the following results:—

Dried by heat.—Too floury, colour good, jelly opaque, but fairly strong.

Drid by air.—Well granulated and of good colour, jelly rather opaque, but not quite so firm as the heat dried.

The market value in Mincing Lane for the first would be about 3*d*., and for the second sample about $3\frac{1}{8}$*d.* for St. Vincent arrowroot of similar quality. Arrowroot produced in the other West India Islands not infrequently turns out less satisfactory than that from St. Vincent, and consequently they never command so good a price. Probably the above if offered in the usual way, viz., by public auction, would not command more than $2\frac{1}{2}$*d.* per lb. The air-dried is decidedly the preferable of the two samples. My judgment is confirmed by one of the largest dealers in arrowroot in Mincing Lane. Singularly enough I find he has had the same inquiry addressed to him lately from Grenada, and I understood him to say has given a reply similar to my own.

I have always much pleasure in giving you any information in my power.

Yours faithfully,
(Signed) D. R. Harvest.

J. R. Jackson, Esq.,
Royal Gardens, Kew.

CCCXLII.—NEW ORCHIDS: DECADE 7.

61. **Pleurothallis maculata**, *Rolfe;* caule primario subrepente, secundario brevi, foliis ellipticis obtusis v. minutissime bidenticulatis valde carnosis, racemis brevibus pauci-multifloris, bracteis campanulato-tubulosis apice obliquis late triangulis subacutis, sepalo postico lineari-oblongo obtuso carnoso basi puberulo lateralibus connatis elliptico-ovatis carnosis puberulis apice bidentatis, petalis obovato-oblongis obtusis glabris, labello pandurato oblongo obtuso carnoso glabro, columna clavata alis carnosis.

HAB. Brazil.

Folia 1–1½ poll. longa, 6–9 lin. lata. *Racemi* ¾–1 poll. longi. *Bracteæ* 1–1½ lin. longæ. *Sepalum posticum* 4–5 lin. longum, *lateralia* paullo breviora. *Petala* 1½ lin. longa. *Labellum*, 1½ lin. longum.

A small species presented to Kew by Messrs. Shuttleworth, Carder, & Co., of Clapham, which flowered in September 1891, and again in the following July. It belongs to Lindley's section *Brachystachyæ*, and is allied to *P. recurva*, Lindl. The leaves are irregularly blotched and spotted with purple, in allusion to which the name is given. The dorsal sepal is light brownish purple above, much paler below, and the lateral ones crimson-purple. The petals are semipellucid white, and the lip purple.

62. **Pleurothallis unistriata**, *Rolfe;* herba dense cæspitosa minuta, foliis spathulatis, lamina elliptico-oblonga obtusa apice minutissime tridenticulata, scapis gracilibus, racemis pauci-multifloris, bracteis spathaceis basi infundibuliformi-tubulosis apice obliquis subobtusis, sepalo postico ovato-oblongo subacuto carinato concavo lateralibus angustioribus et planioribus liberis, petalis spathulatis obtusis, labello lineari-oblongo obtuso-trinervo, columna clavata.

HAB. not recorded.

Folia 9–12 lin. longa, 2–2½ lin. lata. *Scapi* 2–2½ poll. longi. *Bracteæ* ⅓ lin. longæ. *Pedicelli* 1 lin. longi. *Sepala* 1¼–1½ lin. longa. *Petala* ¾ lin. longa. *Labellum* ¾ lin. longum.

A very small species, belonging to the section *Apodæ cæspitosæ*, which has flowered in the Kew Collection on several occasions. It is very near the Guatemalan *P. marginata*, Lindl., which, however, has rather larger, more distant flowers, and the lateral sepals united to their middle. The flowers are semipellucid white; the petals each with a purple mid-nerve, and some similar colour on the lip. As the flowers become old, the colour diffuses itself through the petals and lip.

63. **Pleurothallis pergracilis**, *Rolfe;* herba dense cæspitosa, foliis spathulatis lamina elliptica obtusa valde carnosa, scapis gracilibus, racemis paucifloris, bracteis spathaceis basi infundibuliformi-tubulosis apice obliquis acutis, sepalo postico lanceolato-oblongo subacuto lateralibus fere ad apicem connatis elliptico-oblongis bidentatis, petalis lanceolatis acutis labello lineari truncato leviter bicarinato, columna clavata.

HAB. Belize, British Honduras.

Folia 6–10 lin. longa, 2½–4 lin. lata. *Scapi* 2–4 poll. longi. *Bracteæ* ⅓ lin. longa. *Pedicelli* 2 lin. longi. *Sepala* 2 lin. longa. *Petala* ¾ lin. longa. *Labellum* ¾ lin. longum.

This species has been cultivated at Kew since 1887, when it was received from the Belize Estate and Produce Company. It flowered in May 1892. It belongs to the section *Apodæ cæspitosæ*, and is allied

to the preceding species, from which it differs notably in size, its united lateral sepals, and the very different lip. The flowers are light yellowish white, with a purple mid-nerve to the petals.

64. **Scaphosepalum microdactylum**, *Rolfe;* herba dense cæspitosa, foliis oblanceolato oblongis apice tridenticulatis basi in petiolum attenuatis, scapis erectis gracilibus paucifloris, bracteis basi tubulosis apice triangulis acutis, sepalo postico oblongo basi valde concavo apice carnoso subobtuso lateralibus connatis apice liberis triangulatis breviter aristatis supra medium carnosis, petalis brevissime unguiculatis subobliquis ovatis acutis, labello unguiculato lineari-oblongo obtuso medio bilamellato lamellis denticulatis, columna clavata apice biangulata.

HAB. Not recorded.

Folia 1½–2¼ poll. longa, 3–4 lin. lata. *Scapi* 4–5 poll. longa. *Bracteæ* 1 lin. longæ. *Sepala* 3½ lin. longa. *Petala* 1 lin. longa. *Labellum* 1 lin. longum.

A singular little species, which flowered at Kew during 1890, and again in October of the present year. It is very distinct from every other, though perhaps nearest *S. ochthodes*, Pfitzer. The flowers are light greenish yellow except the upper half of the dorsal sepal, which is suffused with light purple-brown. It is characterised by the very short tails of the lateral sepals, scarcely half a line in length, in allusion to which the name is given.

65. **Masdevallia pusilla**, *Rolfe;* foliis lineari-lanceolatis minute tridenticulatis basi attenuatis, scapis ascendentibus flexuosis basi vaginis tubulosis involventibus, bracteis basi tubulosis apice triangulo-oblongis acutis, ovario exalato, sepalorum tubo campanulato pubescente lobis ovatis concavis caudis gracilibus, petalis lineari-oblongis apice carnosis carinato-angulatis papillosis crenulatis, labelli hypochilio utrinque angulato intus profunde sulcato epichilio saccato trilamellato, columna clavata, apice penicillato-fimbriata.

HAB. Not recorded.

Folia 4–6 poll. longa, 5–6 lin. lata. *Scapi* 3–4½ poll. longi. *Bracteæ* 3 lin. longæ. *Sepalorum tubus* 2 lin. longus, *caudæ* 4 lin. longæ, vix divaricatæ. *Petala* 1¼ lin. longa. *Labellum* 1¾ lin. longum.

This belongs to the section *Saccolabiatæ*, and is the smallest-flowered species of the group. It is readily distinguished from every other by this character, the less open tube of the sepals, and the nearly parallel or scarcely divaricate tails. It is perhaps nearest *M. troglodytes*, E. Morr. The sepals are pale yellowish green, densely spotted with dark purple-brown, and somewhat suffused with a lighter shade; the petals are yellowish white with a pair of large purple-brown blotches, and the lip has many light brown spots and some purplish lines near the base. The sac of the lip is unusually small. It flowered at Glasnevin in August 1891, and on subsequent occasions, when it was sent for determination by Mr. F. W. Moore, the Keeper of the Royal Botanic Gardens.

66. **Polystachya Buchanani**, *Rolfe;* herba cæspitosa, foliis lanceolato-oblongis subobtusis coriaceis basi conduplicatis, racemis paniculatis multifloris, rachibus puberulis, bracteis triangulari-subulatis recurvis, sepalo postico ovato obtuso v. apiculato lateralibus late triangulari-ovatis obtusis v. apiculatis, petalis spathulato-linearibus obtusis v. apiculatis, labello trilobo lobis lateralibus ovato-oblongis obtusis intermedio orbiculari-ovato apice reflexo, callo lineari-oblongo carnoso, disco farinaceo-pubescente, columna brevissima.

HAB. Zambesi district, E. tropical Africa.

Folia 4–7 poll. longa, ¾–1¼ poll. lata. *Scapus* 8–12 poll. longus. *Rami* paniculæ 1–2 poll. longi. *Bracteæ* 1–1½ lin. longæ. *Pedicelli* 3 lin. longi. *Sepala* 2 lin. longa. *Petala* sepalis paullo breviora. *Labellum* 2 lin. longa.

This species bears much resemblance to *P. luteola*, Hook., from Tropical America, and *P. mauritiana*, Spreng., from the Mascarene Islands, and like them has light yellowish-green flowers with a faint trace of purple-brown near the margins of the sepals. It has been in cultivation for several years, having flowered in the Royal Botanic Garden, Glasnevin, in September 1889, and in succeeding years. It was sent from the Upper Zambesi district by Mr. John Buchanan to Mr. James O'Brien, Harrow-on-the-Hill, who has now sent it to Kew for determination. Among African species it may be compared with *P. rufinula*, Rchb. f., which has cinnamon-brown sepals, longer bracts, and larger flowers, though in habit and general character the two are nearly allied.

67. **Cyrtopera papillosa**, *Rolfe*; foliis linearibus v. lanceolato-linearibus acutis plicatis, scapis erectis elongatis apice racemosis multifloris, bracteis lanceolatis acuminatis, sepalis ovato-oblongis subacutis lateralibus pedi columnæ adnatis, petalis paullo minoribus, labello trilobo lobis lateralibus semiovatis obtusis intermedio suborbiculari truncato latere denticulato, disco ad medium bilamellato dein cristato-papilloso, calcare saccato brevissimo, columna brevissima.

HAB. Natal, *Sanderson*! open field at the Dargle; *Fannin*, n. 130! Inanda; *J. M. Wood*, n. 785!

Folia 9–12 poll. longa, 2–5 lin. lata. *Scapi* 1½–2 ped. alti. *Racemi* 2–4 poll. longi. *Bracteæ* 5–8 lin. longi. *Sepala* 5–6 lin. longa. *Labellum* 4–5 lin. longum.

A very distinct *Cyrtopera*, comparable only with *C. foliosa*, Lindl. (*Hook. Comp. Bot. Mag.*, II. p. 203), collected by Drege in Kaffraria, between Basche and Omtata, which has three keels to the lip, a much smaller papillose disc, and various other differences. *C. papillosa* was collected by Sanderson as long ago as 1864, and has recently been imported by Mr. James O'Brien, of Harrow-on-the-Hill, from the same district. It flowered in the collection of Sir Trevor Lawrence, Bart., of Burford, Dorking, in August 1892, and, more recently, with the importer. The flowers are yellow, with the exception of the side lobes of the lip, which are purple brown. The name is given in allusion to the numerous papillæ in front of the keels. The foot of the column is well developed, but the spur excessively short.

68. **Trichocentrum albiflorum**, *Rolfe*; herba nana, foliis ovatis v. ovato-ellipticis obtusis v. apiculatis, racemis brevissimis paucifloris heterochronicis, bracteis ovato-oblongis obtusis, sepalis petalisque obovato-oblongis obtusis, labello elliptico emarginato undulato basi subattenuato et obscure bicarinato calcare brevi apice bidentato, columna brevi latoque alis oblongis subacutis apice recurvis anthera pubescente.

HAB. Mexico; *Finck*.

Folia 1–1¼ poll. longa, 7–8 lin. lata. *Racemi* foliis breviores. *Bracteæ* 2 lin. longæ. *Sepala et petala* 4–5 lin. longa. *Labellum* 6 lin. longum; *calcar* 1 lin. longus.

A curious little species sent to Kew in 1891, by Mr. Hugo Finck, of Cordova. It flowered in September 1892, and again during the present year. It is allied to *T. candidum*, Lindl., from Guatemala, which is apparently the only other species in which the spur is reduced to a very short sac. *T. candidum*, however, has much longer leaves, and various differences of floral structure. In the present species the spur is distinctly bi-dentate. The flowers are white, with the exception of a purple stain at the junction of the lip with the column.

69. **Oncidium sanderianum**, *Rolfe;* pseudobulbis lineari-oblongis apice attenuatis subcompressis, racemis elongatis multifloris, bracteis convolutis oblongis obtusis, sepalis unguiculatis postico late cordato obtuso crispo-undulato lateralibus ovatis obtusis paullo undulatis, petalis late unguiculatis ovatis obtusis valde crispo undulatis apice complicatis annulato - cohærentibus, labello trilobo lobis lateralibus triangulis intermedio oblongo-ligulato obtuso, crista oblonga trilamellata apice tridentata lamellis crenulatis, columna oblonga basi latior alis falcato-linearibus.

HAB. Peru.

Pseudobulbi 3½–4 poll. longi. *Bracteæ* 6–7 lin. longæ. *Sepalum posticum* 1 poll. longum, lamina, 1 poll. lata; *lateralia* 1¾ poll. longa, lamina 10–11 lin lata. *Petala* 1 poll. longa, lamina 8–9 lin. lata. *Labellum* 8 lin. longum. *Columna* 3 lin. longa.

A handsome species of the section *Microchila*, allied to *O. annulare*, Rchb. f. and *O. monachicum*, Rchb. f., both of which have the peculiarity that the petals remain tightly clasped together at their much crisped tips, forming a ring. As regards its general appearance, it approaches the Venezuelan *O. falcipetalum*, Lindl., in which the petals are falcate and much crisped, though, according to ample dried specimens, they usually become free. The flowers are chocolate-brown, the dorsal one with a narrow yellow border. The petals are golden yellow broadly barred with brown, except at their tips. The lip is brown with a yellow crest, and nearly purple side lobes. Plants have recently been imported by Messrs. F. Sander & Co., of St. Albans, from Peru, together with dried specimens, from which this description has been prepared.

70. **Sobralia pumila**, *Rolfe;* herba dense cæspitosa nana, foliis ovato-lanceolatis acutis plicatis, bracteis similibus minoribus, floribus pedicellatis, pedicellis gracilibus, sepalis petalisque lineari-lanceolatis acutis, labello elliptico-oblongo apice fimbriato basi subattenuato disci venis fimbriato-cristatis, columna clavata.

HAB. Island of Marajo, Brazil; *E. S. Rand.*

Planta vix 6 poll. alta. *Folia* 2–3½ poll. longa, 6–10 lin. lata. *Pedicelli* 2 lin. longi. *Sepala* et *petala* 1 poll. longa. *Labellum* 10–11 lin. longum. *Columna* 6 lin. longa.

An unusually small plant for a *Sobralia*, of which a dried specimen has been sent for determination by E. S. Rand, Esquire, of Pará, Brazil. The plant is noted as "forming small tufts, the pseudobulbs "seldom exceeding 3 inches in height. Flowers bright canary yellow, "but very transient, lasting only a day; produced in profusion. Foliage "very dark green." It is allied to the New Granadan *S. fimbriata*, Lindl., which, however, is more than twice as tall, and has larger flowers borne on shorter pedicels. The veins of the lip are crested, but it is difficult to make out their exact details, owing to the difficulty of dissecting out such excessively membranous flowers when once dried.

CCCXLIII.—JARRAH TIMBER.

Eucalyptus marginata, Sm.

The following correspondence is supplementary to the particulars published in the *Kew Bulletin* for September 1890 (pp. 188–190), on the use of Jarrah timber for the purpose of paving the carriageways of public streets.

BOROUGH ENGINEER AND SURVEYOR, ST. PANCRAS, to ROYAL GARDENS, KEW.

Vestry Hall, Pancras Road, N.W.,
25th May 1893.

DEAR SIR,

WITH further reference to the subject of borings in Jarrah and Karri timber, I am sending you to-day two blocks of Karri and one of Jarrah, and also a piece of fir rail, which I came across a few days ago when in the country, which shows oval holes similar to those in the Australian timber, and perforating the wood promiscuously with regard to grain; in this timber I found grubs actually at work. Having in mind the fact that the particles of wood, in many cases filling the holes in the Australian wood without any compression, which would have taken place had the hole been originally circular and compressed to oval form by the process of the growth of the tree as you suggest, I am induced to form the conclusion that the borings have been made since the tree was felled. I think the less resistance offered to the action of the worm on lines approximately concentric to the rings of the tree is sufficient to explain the preponderance of holes in that position; but in the blocks sent you will find holes which vary somewhat from that course, and in the piece of fir you will notice how the whole of the surface immediately under the bark has been removed by the action of the grubs, which also penetrate the timber in varying directions, but again adopt a course which they found they could more readily pursue. In the Jarrah blocks I send, you will notice the holes are entirely different, being more of the nature of worm-eaten wood commonly found in our local timbers, particularly beech and oak, and which boring is undoubtedly done after the timber has been cut and often made up into furniture.

I had a copy sent me of a weekly paper, "Timber," dated May 20th, 1893, in which is printed a letter from Cathcart W. Methuen, Engineer-in-Chief to the Natal Harbour Board, in which he describes experiments made with Madagascar timbers as compared with samples of Australian Jarrah wood, and also greenheart, and he concludes by stating that the Jarrah, greenheart, and other timbers have all been more or less severely attacked by the worm, while the Madagascar timbers mentioned have been practically untouched.

I must thank you for the attention you have given in this matter and for your kind reply, in which you refer me to Mr. Maiden's book, which I shall certainly look at.

I am, &c.
(Signed) W. N. BLAIR,
Engineer and Surveyor

J. R. Jackson, Esq.,
Curator of Museums,
Royal Gardens, Kew.

BOROUGH ENGINEER AND SURVEYOR, ST. PANCRAS, to ROYAL GARDENS, KEW.

Vestry Hall, Pancrás Road, N.W.,
September 2, 1893.

DEAR SIR,

WITH reference to the matter on which we exchanged a few letters some months ago, viz., the boring in Karri wood, which we can now submit some further evidence on, for several insects have been found in the blocks, and I forward herewith a specimen unavoidably broken up somewhat seriously, but still it will be recognisable.

I have also a block in the office here with the insect in the hole undisturbed, and it is placed with its tail towards the termination of the hole, so that I conclude it did not crawl into the hole, but was hatched from the larva, and has not been able to move.

I shall be pleased to hear your views on the point, and only venture to trouble you because I know you will be interested, and so kindly offered to assist in discovering the cause of the holes in the woods.

Yours faithfully,
(Signed) W. N. BLAIR.

J. R. Jackson, Esq.,
Royal Gardens, Kew.

MR. W. F. H. BLANDFORD to ROYAL GARDENS, KEW.

48, Wimpole Street, W.,
October 9, 1893.

DEAR SIR,

THE box forwarded to me, containing a piece of wood and a specimen of the insect attacking it, reached here before I got home at the end of my holidays. I would have written about it sooner, but have wanted to identify the species concerned, and have been too busy to pay a visit to South Kensington for the purpose.

But not to delay longer, I may say at once that the block has been bored by the larvæ of an exotic longicorn beetle belonging to the family *Prionidæ;* the workings of the larva have certainly been begun in the natural home of the tree, and probably while the tree was still standing. Of this I cannot be sure, for many *Longicornia* attack felled trees, laying their eggs in the bark, and, when this is the case, it is usual to remove felled timber as quickly as possible, or to bark it if it must be left lying for some time before deportation. I think, however, that it is more probable that the borings were not begun after the tree was felled. The only further injury that such wood is likely to incur after shipment is due to the completion of the larval burrows. The grubs are not readily killed *in situ*, but it may be done with a wire, but, as a rule, there is too much débris in the burrows to allow of either a wire or liquid reaching them.

The oval shape of the burrows is constantly that of the burrows of *Longicorn* grubs, and corresponds to the transverse section of the grub at its largest point. It would suffer no material change by the growth of the tree.

Nothing need be done in this country except to reject obviously unsound timber for road-making, though I should think that pieces slightly bored might be used, at least if the upper part were sound.

I will return the specimens soon, and I hope with the name.

Yours faithfully,
(Signed) W. F. H. BLANDFORD.

CCCXLIV.—MISCELLANEOUS NOTES.

MR. CARL WILHELM ZIMMER, a German member of the gardening staff of the Royal Gardens, was appointed (July) Foreman in the Botanical Garden, Munich.

MR. WALTER HAYDON, a member of the gardening staff of the Royal Gardens, left Kew in September to undertake the duties of Acting Curator of the Botanic Station at Lagos during the absence on leave of the Curator, Mr. Henry Millen.

MR. WILLIAM SCOTT, formerly of the Royal Gardens and latterly Assistant to the Director of Forests and Botanical Gardens in Mauritius, has been appointed Director in succession to Mr. John Horne, F.L.S., retired.

The **Royal Scottish Arboricultural Society**, under the guidance of Colonel Bailey and Mr. Malcolm Dunn, of Dalkeith, visited the Royal Gardens, Kew, on August 12th, and inspected the principal objects of interest in the Gardens, Arboretum, and Museums. The party numbered 120, and included many of the leading Foresters and Gardeners of Scotland.

Aloe abyssinica, *var.* **laxiflora,** *Baker.*—A very distinct variety of this species is now flowering in No. 5. It differs from the type and from the variety *Peacockii* (figured in *Bot. Mag.*, t. 6620) by its unspotted bright green leaves, very long pedicels, and short reddish yellow flowers, with stamens not at all exserted.

A considerable number of new species of *Aloe* have been found lately by Dr. Schweinfurth in the mountains of Arabia and Abyssinia, which have not yet been introduced into cultivation.

Rhus cotinoides.—Several years ago we received at Kew seeds of this rare North American tree from Professor C. S. Sargent, of the Arnold Arboretum. For the first two or three winters the young shoots were badly injured by frost, and the plants had to be sheltered; since then, however, although the growth is not so vigorous as that of its nearest European relative, *Rhus Cotinus*, it seems to hold its own, and proves to be hardy at Kew. The autumnal tints assumed by the decaying leaves are especially brilliant, bright crimson and orange-red. The following particulars are extracted from Professor Sargent's magnificent work, "The Sylva of North America," where the species is figured under the name of Cotinus americanus:—*Rhus cotinoides* was first discovered by the Englishman Thomas Nuttall in 1819, on the banks of Grand River, a tributary of the Arkansas, within the present limits of Indian territory. Twenty-three years later it was found by Buckley in Alabama, where it grows in a few localities north of the Tennessee River, on the south slopes of the Cumberland Mountains, in the neighbourhood of

Huntsville. It also occurs on the Cheat Mountains, in Eastern Tennessee, and in the valley of the Medina River, in Western Texas. In its native habitats it attains a height of 25 to 35 feet, with a trunk 12 to 14 inches in diameter.

Robinia hispida, ***Linn.*****, in fruit.**—This well-known shrub, which is a native of the Eastern United States, where it forms in some localities a considerable portion of the underbush, reproduces itself by means of suckers; its fruit being until quite recently almost unkown. Mr. Thomas Meehan, of Germantown, Philadelphia, who has studied the plant in its wild state on the Lookout Mountains, Tennessee, having made extensive inquiries as to the occurrence of seed vessels without success, concluded that, owing to the rapid production of suckers, the seed-producing power had been lost. At length he received two specimens, one of which he generously presented to Kew. The pod, which is rather more than two inches long and tipped by a short curved beak, is covered with weak brownish bristles about four lines long, and is slightly constricted between the seeds. Several pods mature on the same raceme.

Bamboo and **Arundo** from the **Shiré Highlands.**—Kew is indebted to the Right Hon. Lord de Saumarez, for plants of a Bamboo which is probably *Oxytenanthera abyssinica*, Munro, a widely distributed species in tropical Africa, and *Arundo madagascariensis*, both of them new additions to the Kew collection. His Lordship writes:—
" I received them in 1889 from our Consul at Zomba, near Lake
" Nyassa, Mr. John Buchanan. They are less hardy than I hoped, for
" during the last winter the frost shrivelled up their leaves in an
" unheated greenhouse, where I have hitherto kept them. I am afraid
" it will be useless to try them out of doors even here."

Oxytenanthera abyssinica is described by Munro as having stems from 25 to 50 feet high, from 1½ to 3 inches in diameter at the base, and leaves 6 inches long by about an inch in width. He says:—" This fine
" distinct looking bamboo seems to have a wide range in Africa,
" extending into both tropics. Barter says that it was the only
" arboreal grass he had seen (in Baikies' Niger Expedition), and that
" the stems were used to pole canoes, and the smaller ones as shafts for
" spears."

Arundo madagascariensis is a reed of very wide distribution in tropical and subtropical Asia and Africa, though originally only known to inhabit Madagascar. It grows from 10 to 20 feet high, and has relatively slender culms terminating in large feathery panicles similar to "pampas grass."

Duroline for **Wardian Cases.**—Duroline is a translucent, waterproof, pliable material, which is manufactured by the Wire Wove Roofing Company, 75, Queen Victoria Street, E.C., and is recommended and used as a substitute for glass for roofing large buildings, &c. It has for its basis a web of fine iron wire with warp and weft threads, and is covered with a thick translucent varnish. It is easily bent, can be cut with strong scissors, and is said to be weather and heat proof. Samples of it were sent to Kew in October last by the manufacturers, inviting "attention to the special applicability of our patent unbreakable glazing "material, Duroline, for the glazing of Wardian cases, in which plants "are sent and received from abroad. We believe much damage and "annoyance results from the breakage of glass in these cases."

Six Wardian cases were, therefore, "glazed" with this material, and were despatched filled with plants to Ceylon, Australia, Jamaica, and Lagos during the summer. In every case they were favourably reported upon, and some of them have been returned to Kew filled with plants which reached us in good condition. The only drawback we have found in Duroline as a substitute for glass in Wardian cases is its stickiness inside after it has passed through the tropics, and the consequent glueing to it of the plants where they touch. This stickiness is due to the moisture and warmth inside the case. The manufacturers say "the "more Duroline is exposed to weather the harder it becomes." On the whole, we can report favourably upon Duroline for Wardian cases. We also think it might be used for many purposes in the roofing of sheds and plant structures in tropical countries.

Ophiopogon japonicus.—Specimens of this plant were recently sent to Kew for identification by H. Labouchere, Esq., M.P. "About the "Lake of Como, in many of the villas, they have a sort of grass which "they call 'erba japonica.' Its advantage is that it grows thickly "beneath the trees or in the sun, and stands the frost. It makes a "thick bed, and they use it for borders or for spaces that they wish to "cover, in the latter case cutting it short. . . . . It seems to me "that if it were introduced here it would be useful for gardens and "shrubberies. I never saw it except about Como, and I was told that "it was introduced there by the Grand Duke of Saxe-Meiningen, who "has a villa there." According to the 'Genera Plantarum," the name given at the head of these notes is the one which should be employed. It is met with in some French gardens under the name of *Convallaria japonica* (herbe aux turquoises), and in some books as *Flueggia japonica*, the name adopted by Mr. J. G. Baker when he monographed this genus and its allies. In "Garden and Forest" for 1889 Mr. Nicholson, in notes on gardens, &c., about Lugano, thus writes: —"As an edging (and a capital one too) for shady walks, and also as a "sort of turfy covering to the bare ground under the dense shade of trees, "*Flueggia japonica* was successfully employed. A pretty little "plant, with dark green grassy leaves and blue berries . . . . . . ; "there being not many things which thrive under these conditions, it seems desirable to call special attention to its merits." We learn from Kaempfer that it is similarly employed in Japan and China, and also that the tuberous knobs of the rhizome are preserved in sugar and used medicinally. A figure of the plant is given in the *Botanical Magazine*, t. 1063.

The "Index Kewensis."—The appearance of the first part of this great work calls for something more than a mere record. Since the publication of the second edition of Steudel's "Nomenclator Botanicus," in 1840–1, there has been no other attempt to collect and publish the names of the thousands of plants described in the botanical literature of all nations. But Steudel's work is merely an alphabetical catalogue of plant names, with the native countries of the plants and some other details. The "Index Kewensis" is what its title implies, as it gives references to the place of publication of each genus and of each species. The foundation of this work, on which Mr. B. Daydon Jackson and several assistants have been engaged ever since January 1882, may be claimed for the late Sir William Hooker, who had an interleaved copy of Steudel's "Nomenclator Botanicus," in which he entered, or caused to be entered, all new names as they were published. This was commenced the same year that Kew Gardens were opened to the public, and it has been continued down to the present day, though there are doubtless some arrears in species. The practice is to post up, at least, all names of plants that are laid into the herbarium, and all names of new genera published in all the new books acquired for the library. Some years ago Sir William Hooker's interleaved "Steudel" was so full of manuscript that it was necessary to take some fresh step. Accordingly two copies of Steudel were procured and mounted on large folio paper, one column on each page, leaving two blank columns for the manuscript additions. The whole forms four huge folio volumes, and was prepared and continued chiefly at the expense of the late Mr. G. Bentham. In this way Mr. Daydon Jackson had something approaching a complete list of names of plants to start with, and he has during the last 11 years laboured continuously at the superstructure, the first part of which was in the hands of botanists early in September. For the history of the publication of the "Index Kewensis" we cannot do better that quote Sir Joseph Hooker's brief preface to the work:—

"Shortly before his death, Mr. Darwin informed me of his intention to devote a considerable sum in aid or furtherance of some work of utility to biological science; and to provide for its completion, should this not be accomplished during his lifetime. He further informed me that the difficulties he had experienced in accurately designating the many plants which he had studied, and ascertaining their native countries, had suggested to him the compilation of an Index to the Names and Authorities of all known Flowering Plants and their Countries, as a work of supreme importance to students of Systematic and Geographical Botany, and to horticulturalists, and as a fitting object of the fulfilment of his intentions.

"I have only to add that, at his request, I undertook to direct and supervise such a work; and that it is being carried out at the herbarium of the Royal Gardens, Kew, with the aid of the staff of that establishment."

Sir Joseph Hooker himself has most generously devoted an immense amount of time to the herculean and monotonous task of revision, and has brought his vast personal knowledge to bear on the independent but by no means inconsiderable task of settling the geographical distribution. Mr. Daydon Jackson estimates that the complete work will contain about 400,000 names and many more references; and the first part contains nearly 110,000 names. The period covered is from the establishment of binominal nomenclature by Linnæus down to the end of 1885. If nothing occurs to hinder the present rate of progress the whole work will be issued by the middle of 1895.

Africa.—Kew has received, through Mr. A. J. Swann, a third instalment of dried specimens collected by Mr. Alexander Carson in the neighbourhood of Lake Tanganyika. The parcel contains 138 numbers, representing about 90 species. The most interesting of these are a new genus of Tiliaceæ, with digitate leaves, allied to *Honckeneya*, which will be figured and described by Professor Oliver in Hooker's *Icones Plantarum;* a new species of the curious Euphorbiaceous genus *Synadenium;* a new species of the Boraginaceous Cape genus *Lobostemon*, only gathered once before in Tropical Africa; a new *Moræa*; a new *Lapeyrousia* and six new *Gladioli*, two of which have large flowers, and would be valuable as garden plants.

Disporopsis.—Two sheets of specimens, without flowers, which have been for some time in the herbarium, prove, on comparison with the type in the British Museum to belong to the curious Liliaceous genus *Disporopsis*, described by the late Dr. Hance, in the "Journal of Botany," 1883, p. 278. This genus resembles in habit *Disporum* and *Polygonatum*, but differs from both of these in possessing a corona, which springs from the throat of the perianth-tube in a similar manner to that of *Narcissus*. This corona is slightly shorter than the perianth lobes, tubular and divided rather more than half-way down into six segments, each of which is bifid at the apex. The six stamens alternate with the segments of the corona. *D. fusco-picta*, Hance (the only known species) has a creeping rizome, from which spring numerous erect branches about six inches high, bearing solitary, cernuous, white flowers in the axils of the leaves. It was first found by the Rev. E. Faber on the Lofau mountains, near Canton, and subsequently collected by Dr. A. Henry, at Kuei (No. 6,168) and Fang (No. 6,705), both in the province of Hupeh. It has not yet been brought into cultivation.

Shantung Cabbage (*Brassica chinensis*, L.)—In the *Kew Bulletin* for May 1888, p. 137, an account was given of this Chinese vegetable, of which seeds had been sent to the Royal Gardens in the preceding year by Mr. George Hughes, late Commissioner of Customs at Chefoo, China. Plants raised from them ripened a good crop of seeds at Kew, which were distributed to a few correspondents interested in new vegetables. The following notice is taken from the "Garden," November 18, 1893, p. 472:—

"Being specially fond of vegetables, I tried a few years since some seeds of Shantung cabbage, for which I was indebted to Kew. For two years I thought it worthless, its open heartless heads running up to seed very quickly. But this year I sowed the remains of my seed, and yesterday a dish of what appeared to be beautifully white Cos lettuce was brought to me. Boiled, at dinner, I found it most insipid and worthless, simply so much tender green vegetable between the tongue and teeth, with absolutely no flavour to the palate. To-day I have tried it as a salad, and I find it excellent, white, crisp, and sharp as the best summer Cos lettuce. Worthless as a vegetable, but of great value as supplying an excellent late autumn salad.

"R. MILNE-REDHEAD,

"Holden Clough."

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 84.] DECEMBER. [1893.

CCCXLV.—ROOT DISEASE OF SUGAR-CANE.

The July number of the *Kew Bulletin* contained an account of a disease which has within the last few years made its appearance amongst the sugar-canes in the West Indies. It proves to be due to a fungus, hitherto undescribed, to which the name of *Trichosphæria* has been given. It attacks the parts of the plant above ground. As it has been found at Kew to readily develop on the young leaves of the bamboo, it is not improbable that it will also attack other *Gramineæ*. Its original host was therefore probably some indigenous or introduced grass, from which it has transferred itself to the sugar-cane.

More recently another disease has been the subject of investigation at Kew, which, unlike the *Trichosphæria*, does its chief mischief by attacking the "roots" of the young plant, and thus arresting, in consequence, the development of the canes. The following correspondence gives the history of the matter. As it appears to be identical with a disease originally described in Java, it is not impossible that it has been introduced from the East Indies.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, October 21, 1893.

I AM directed by the Marquis of Ripon to transmit to you the accompanying copy of a Despatch from the Governor of Barbados, with its enclosure, and to request that you will be good enough to report on the specimens of canes attacked with a root disease which the Superintendent of the Botanical Station in Barbados has forwarded to you.

I am, &c.
(Signed) JOHN BRAMSTON.

The Director,
Royal Gardens, Kew.

GOVERNOR OF BARBADOS to COLONIAL OFFICE.

Government House, Barbados,
October 3, 1893.

MY LORD MARQUIS,

I HAVE the honour to enclose an extract from a minute from the Superintendent of the Botanical Station on the subject of a cane disease, specimens of which he is sending to Kew for examination.

2. I shall be glad if your Lordship will be so good as to ask the authorities at Kew kindly to make the desired report on the specimens sent by Mr. Bovell.

I have, &c.
(Signed) J. S. HAY.

The Most Hon.
the Marquis of Ripon, K.G.,
&c. &c. &c.

[Enclosure.]

SUPERINTENDENT, Botanical Station, to COLONIAL SECRETARY.

HON. COL. SECRETARY,

* * * *

I HAVE the honour to respectfully ask permission to be allowed to send next mail to Kew specimens of the canes which are being attacked in St. John's parish with a root disease, and at the same time to say that his Excellency is writing to the Secretary of State for the Colonies requesting him to ask the authorities at Kew to be so good as to have them reported on.

2. In the early part of 1891 I forwarded to Kew specimens of this root disease, and Mr. Massee was asked to report on them; this he did, but owing to the absence of fruit on the specimens he was only able to hazard the opinion that the fungus belonged to the genus *Botrytis*. Now I hope by sending a couple of stools of canes with the soil adhering to the roots the matter may be definitely settled.

(Signed) JOHN R. BOVELL.

September 28, 1893.

EXTRACT from Letter from CURATOR, Botanical Station, Grenada, to ROYAL GARDENS, KEW, dated August 4, 1893

I have just returned from Barbados. While there I had a careful investigation of the fungus attacking the sugar-cane, in company with Mr. Bovell. It has caused terrible havoc on some of the estates in St. John's parish. Many of them will take five or six acres to make a hogshead. What struck me at the first glance was that in all the diseased fields it was only the Bourbon cane affected. The Caledonian Queen and Transparent are healthy and vigorous. It does not seem to me to require much study as to the best course to pursue, but Mr. Bovell tells me that so conservative are the planters that they will persist in attempting to grow the weaker Bourbon on a soil evidently unsuited for it.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew,
November 3, 1893.

SIR,

I HAVE the honour to acknowledge the receipt of your letter of October 21, transmitting a copy of a Despatch from the Governor of Barbados on the subject of a root disease of sugar-canes.

2. The specimens sent by the Superintendent of the Botanical Station have been carefully examined, and I enclose a technical report upon them.

3. The disease is totally distinct from that which was the subject of my letter of April 5 last. It is practically identical with one which exists in Java, from which it is not improbable that it has been introduced.

4. It is evident that the weak point in sugar-cane cultivation in the West Indies is the want of care in the propagation of the canes. The very finest and most healthy canes should be scrupulously selected and set apart for the purpose. Unfortunately, any weakly or even diseased canes appear to be thought good enough. Apparently, in consequence of this short-sighted practice, a disease, which under ordinary circumstances would have been of little moment, has assumed troublesome dimensions.

5. It appears to me that the cultivation of the sugar-cane generally in Barbados is not prosecuted with much intelligence. The outbreak of disease in a cultural staple is not always to be looked upon as simply "the act of God," but is often aggravated, if not actually produced, by the neglect of reasonable precautions.

I long ago pointed out, and it is now beginning to be understood, that an immense deal can be done for the improvement of the sugar-cane by the continuous selection for propagation of the best possible canes. Not merely should this be done systematically on individual estates, but it should be carried on at the Botanical Station. In the latter case, the canes should be systematically analysed in order to select those canes which are richest in sugar.

6. In this connexion, I am sorry to learn from Mr. Bovell, in a letter which accompanied the specimens of diseased canes, that nothing has been done with regard to the provision of a larger experimental station. A committee appears to have been appointed by the Legislative Council to consider the matter and was allowed to lapse without reporting.

7. In conclusion, I must point out that, though Kew may be able to be of some assistance in technical matters like the present, it cannot supply the cultivator with the energy and intelligent resource, without which no industry in the long run can be successfully prosecuted.

I am, &c.
(Signed) W. T. THISELTON-DYER.

John Bramston, Esq., D.C.L., C.B.,
Colonial Office, Downing Street, S.W.

REPORT on "ROOT DISEASE" of SUGAR-CANE from BARBADOS.

The stools of sugar-cane sent to Kew by Mr. Bovell from Barbados, for the purpose of ascertaining the cause of the "root disease," arrived in excellent condition for that purpose, and an examination of them demonstrates conclusively that the disease is due to a parasite fungus known as *Colletotrichum falcatum*, Went. The fungus cannot effect an entrance through the unbroken surface of the stem of the sugar-cane. But the conidia germinate on decaying lateral shoots, or the ragged base left by fallen leaves. Its entrance into the living portion is indicated by a bright red coloration of the fibro-vascular bundles, the colour subsequently extending to the ground tissue.

When an entrance has been effected the hyphæ spread rapidly throughout the length of the cane, and after a time the fructification ruptures the epidermis in the neighbourhood of the joints, and appears on the surface as a more or less effused, black, minutely velvety patch.

Microscopic examination shows the velvety appearance of the fruiting patches to be due to the presence of numerous rigid, dark-coloured hairs, springing from a dense basal weft of colourless hyphæ; these latter also bear large numbers of minute, colourless conidia, or reproductive bodies. The conidia are capable of germinating the moment they are mature, and, being produced quickly and readily disseminated, easily infect neighbouring plants.

A second kind of conidia are formed on the oldest portions of mycelium present in the tissues, two or three large globose conidia being frequently found on the hyphæ present in a single cell of the cane. These internal conidia can only escape when the cane in which they exist has become thoroughly decayed. The fungus, under normal conditions, attacks the above-ground portions of the cane, the "root disease" condition being a modification of the normal form, called into existence by the method of cane cultivation adopted.

A careful examination of all the canes forwarded shows that the portion buried in the ground contains much more mycelium than that above ground; the mycelium in the root is also more mature, frequently producing enormous quantities of conidia in the cells. In some instances the root was rotten and decayed, the disintegration being effected by the fungus; nevertheless there is not the slightest evidence to favour the idea that the disease originated *after* planting. Many of the small roots contained a large quantity of mycelium, but it was evident in every case that this had passed from the stock into the root. On the other hand, everything points to the conclusion that the portions of cane used for propagation already contain the mycelium of the fungus, although its presence may not be indicated externally, and that the mycelium present in the buried portion of the cane, favoured by darkness and moisture, develops at an abnormal rate, thus assuming the character of a disease, which in its intensity is foreign to the fungus when developing under normal conditions. Two additional species of fungi, not in any way connected with the disease, were common on fading leaves of the canes; the one, a species of *Chætostroma*, the other a *Botrytis*. The last mentioned was also found on canes sent previously by Mr. Bovell, and it was suggested at the time that it might be connected with the disease. But further investigation has not in any way confirmed this; the *Botrytis* may for the future be dismissed from consideration.

The sugar-cane disease in Java, called *Rood Snot*,* is apparently the same thing, and it would be interesting to ascertain if this is the source from which it has been introduced into the West Indies.

SUMMARY.

The disease is caused by a parasitic fungus called *Colletotrichum falcatum*, Went., and the evidence points to the injudicious use of diseased canes for propagation as the cause of the injury to the crop which is now experienced.

PREVENTIVE MEASURES.

1. All diseased canes should be burnt and not allowed to decay naturally.

2. Perfectly healthy canes should be used for propagation, and to secure this, the canes should be obtained from an area not infected with the disease.

3. Mr. Bovell, in a letter addressed to Kew, says:—"I have managed "to stamp out the disease here by growing other crops on the fields "attacked, for a year or two." This is a very essential point, as the litter of cane leaves, &c. on the ground will be infected with the fungus,

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* Het *Rood Snot:* Dr. Went (H. van Ingen: Soerabaia, 1893).

and perfectly healthy plants would be attacked if planted at once on an infected site.

4. There is reason to think that if perfectly healthy and uninfected canes were only used for propagation, the disease would not be found to give much trouble.

G. M.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, December 19, 1893.

I AM directed by the Secretary of State for the Colonies to transmit to you a copy of a Despatch from the Officer Administering the Government of Barbados, conveying the thanks of his Government for your report on sugar-cane disease.

I am, &c.
(Signed) R. H. MEADE.

The Director,
Royal Gardens, Kew.

The OFFICER ADMINISTERING THE GOVERNMENT OF BARBADOS to COLONIAL OFFICE.

Government House,
November 30, 1893.

MY LORD MARQUESS,

I HAVE the honour to acknowledge the receipt of your Lordship's Despatch, No. 118, of the 7th instant, forwarding a copy of a letter and report from Mr. W. T. Thiselton-Dyer on the subject of cane disease now prevalent in Barbados.

2. On behalf of the Government of Barbados, I beg your Lordship to convey my sincere thanks to Mr. Thiselton-Dyer for all the trouble he has taken, and for his valuable report, which will be of great use to the planters.

I have, &c.
(Signed) GEORGE PATON, Major-General,
Acting Governor.

The Most Hon.
the Marquess of Ripon, K.G.,
&c. &c. &c.

EXTRACT from LETTER from C. A. BARBER, Esq., F.L.S., Superintendent, Agricultural Department of the Leeward Islands, to ROYAL GARDENS, KEW, dated Coverley Estate, Barbados, December 1, 1893.

I have carefully examined canes attacked by a disease which is known locally as "root fungus." The general effect of this disease is that canes planted in December appear to receive a check in their growth about June or July following. As the time proceeds the plant gradually dwindles, although many attempts are made by fresh basal shoots to supply the place of dying ones. After the lapse of six months, *i.e.*, in November or December, on the eve of crop time, no *cane* has been formed, growth having apparently been completely arrested.

This disease attacks Bourbon canes much more frequently than the other varieties, such as Caledonian Queen, Striped Singapore, and Purple Transparent, which are met with in the same fields. The Caledonian Queens are not very good, but they are arrowing freely, and the difference between them and the Bourbons in the same field is marked enough.

I have been over the country where the attack is severest, and have collected typical specimens and placed them in alcohol on the spot. (The loss in one estate is perhaps 75 per cent.)

The strictures passed on the cultural methods pursued in Barbados in the correspondence with the Colonial Office having been held to be too severe, the following extract from a local paper is published. The testimony of an eye-witness on the spot conclusively proves that the faultiness of the methods pursued has been by no means over-rated.

EXTRACT from *Barbados Bulletin*, December 12, 1893.

REFUSING TO BE WARNED.

After the repeated warnings which our planters have received from the Kew authorities respecting the prevalent cane diseases and the necessity of being careful in the selection of seed, or cane-plants, many of our planters are still pursuing the old and irrational methods of selection that have been condemned by those who speak authoritatively on the subject. While passing through several estates last week, we witnessed the process of collecting and selecting cane sprouts for planting, and on carefully examining their quality, in order to ascertain if sufficient attention had been given in their selection, we found on one estate (managed by one of the oldest, most experienced, wealthiest, and respected planters in this island) that a large quantity of plants had been purchased from labourers on the estate who had grown small, stunted, sickly-looking canes on the poor patches of soil around their huts, and it is from these stunted canes the sprouts had been taken. On another estate we saw plants selected for sowing that had the rind fungus on many of them, which the unscientific overseer assured us would be destroyed in the process of soaking in lime-water before planting; and on a third estate, one of the largest in the island, we saw a great heap of plants, many of which on examination were found to be attacked with the borer. Here, then, were men boasting of their experience as planters, who were engaged in propagating disease by sowing the very evils against which they profess to be contending. A more suicidal policy could not be imagined. And on asking one of these agricultural wise-acres why such poor seed had been selected, and why a nursery of strong, healthy canes had not been established on the estate for the purpose of supplying it with good, vigorous seed plants, he replied that they could not afford to divert sufficient land for the purpose, and that it was cheaper to buy sprouts from the labourers than to grow them as we had suggested. Some, indeed many, of our planters are annoyed because Mr. Thiselton-Dyer has laid the blame of the prevalent cane-pests at their door; but if his statement needed any vindication, that the planters are themselves largely responsible for the evils that exist through their neglect of necessary precautions and their carelessness in selecting cane plants, that vindication the planters are themselves supplying by following the condemned customs of the past and recklessly pursuing a course that can only tend to the perpetuation and increase of the evils they profess to be anxious to avert.

CCCXLVI.—PERUVIAN COLONISATION.

The Peruvian Corporation, Limited, has undertaken an interesting experiment in planting enterprise.

It has obtained possession, for the purpose, of a tract of country in Central Peru, east of the Andes. It extends for a distance of about 40 miles along the course of the Perené river, a tributary of the Amazons, from the River Eneno (1,700 feet), to the Cascades (1,050 feet), and to a distance of 30 miles on either side of the Perené.

The land was reported on to the Corporation by Mr. P. D. G. Clark, a member of the Gardening staff of the Royal Botanic Gardens, Ceylon, in 1891.

West of the area is the Chanchamayo Valley, traversed by the River Chanchamayo, which runs into the Perené. An account of its products will be found in the "Reports from the Consuls of the United States" for June 1893.

The railway from Callao and Lima has been now completed to Oroya, 136 miles from Callao.

Mr. Daugherty, the United States Consul, reports: "From Oroya to "the head of the valley of Chanchamayo, one of the most fertile dis- "tricts of Peru, is a distance of about 40 miles, and the products of this "valley that find their way to the coast now come on the backs of "mules, donkeys, and llamas to Oroya, over rough mountain roads, "which, for most of the distance, are mere paths."

The enterprise is still in its infancy. The following papers are published for general information. They have the merit of avoiding too roseate a picture, of recognising difficulties, and of fairly indicating the conditions which will alone command success.

The Peruvian Corporation, Limited, to Royal Gardens, Kew.

66, Old Broad Street, London, E.C.,
4th October 1893.

Dear Mr. Thiselton-Dyer,

I think you know that we are doing a little planting in the Andes in Peru near the Perené river. Our man there says he has got 80,000 seedlings of coffee, obtained no doubt from his own district. He expresses a desire now to have a quantity, say five bushels, of Blue mountain seed. Can you kindly tell me the best person to write to in Jamaica. The idea of having two classes of coffee growing is, I believe, that by this means he hopes to avoid the diseases which did so much harm in Ceylon and elsewhere, from propagating too closely from one jàt.

I enclose you copy of a letter from Mr. Robb, dated 27th July last, giving a general report for the year ending 30th June, which may interest you, and perhaps you may think fit to incorporate some of it in your *Kew Bulletin*. Mr. Mackenzie is in charge of the Colony up there, and Mr. Robb, the writer of the letter, is the man who has been in special charge of the nurseries.

* * * * * *

Yours, &c.
(Signed) Alfred Dent.

W. T. Thiselton-Dyer, Esq., C.M.G.,
Royal Gardens, Kew.

(Enclosure.)

The Peruvian Corporation, Limited,
(Colonisation Department),
27th July 1893.

Dear Sir,

I herewith beg to hand you my report on the colonisation, lands, prospects, &c., for the year ending 30th June.

Colonisation.—I very much regret to say that during the past year not so much progress has been made by the colonists as we could have wished. Some have done fairly well, and have now got a good footing on their lands, with nice crops of maize, yucca (*Manihot utilissima*), beans, vegetables, &c., and with a little ground cleared for planting coffee at the end of the year, and I think it but fair to especially mention the colonists around Metraro and Dentville as being the most industrious. Others have not done well, and have been the cause of much trouble and expense. A few have abandoned their chacras and left this part of the country, and some who remain will, I am afraid, never be successful.

The cause of this can without doubt be attributed to the most undesirable class of colonists introduced, such as runaway sailors and adventurers of every description, who arrived in the colony absolutely destitute, and without responsibility of any kind. It cannot be expected that such men will ever make successful colonists. Their wandering habits never allow them to remain long in a place, and work of any description is distasteful to them. A single man without means, let him be ever so good and anxious to do well, can never make any real progress or be a successful colonist. In the first place, he has to cook his food and attend to his house, which occupies a good part of his time, and, on the other hand, he cannot cultivate with any chance of success more than about three acres of land, the produce of which would barely keep him alive, far less enable him to repay his debts.

If successful colonists are to be established on the lands, they will have to be selected from a very different class than heretofore, and as a rule families only, with a little means of their own. With the kind assistance given by the Corporation they would, in a few years, form a home and reap the benefit of their labours.

I am very sorry to say that French and Italian colonists appear to lack that steady perseverance shown by the more northern races, and it is from the latter class I would recommend the trial of a few families. It would be far more satisfactory to have, say, a dozen good families with means of doing well than a host of greedy avaricious adventurers, whose whole aim is to get what they can out of the Corporation without doing anything in return.

The injudicious selection of lands has been the cause of much trouble and of colonists leaving, and it is a matter of regret that more care was not taken by the representatives of the Corporation who settled them. A number located at Punisas above San Luis had no possible means of getting out their crops, and in consequence have lost heart and left. Others have been settled on sand beds swarming with ants and other destructive insects, and cannot be expected to remain contented. These people have since been removed to better lands, and no doubt they will now do well.

It would be to the interest of the Corporation to seriously consider the introduction of colonists with means, as they would not only be the backbone of the colony, but would act as a stimulus to others. There are undoubtedly good men at home who would be only too glad to know of this territory and its capabilities, and with such colonists a very different result would be obtained.

Lands.—The lands around Perené are not of a desirable nature, and are unfit for anything further than light crops, such as maize, rice, &c., but a few miles down the river I have found excellent lands suitable for tropical cultivation of any kind. In most instances I found the lay of the hills so steep that cultivation was out of the question, but, on the other hand, I also found valleys and slopes that would be hard to surpass in any part of the world, and it is in such localities that we can look for success.

There is a great variety of soil, and for the most part extremely rich. In many places I find a rich dark loam with a rocky, gravelly bottom, and in other places it inclines to a sandy clay. I would especially mention the valley of the Yuranaki as an exceptionally good site, both as regards lay of land and suitability of soil, but undoubtedly there will be other parts equally good when opened up.

Along the banks of the river several valuable claims are to be found, extending for hundreds of acres, and for sugar-cane or rice culture would be very profitable.

Cultivation.—It has never been my lot to live in a country where the necessaries of life can be so easily grown, and a colonist with a little foresight can soon furnish nearly all he requires for his table from his own estate. Maize, rice, vegetables, fruits, &c., all grow freely and with little or no trouble. Oranges, lemons, and citrons also grow in abundance, and with a little trouble orchards could be laid out and any quantity of fruit grown for canning purposes.

European fruits could in any places be planted and grown with success, and I hope the day is not far off when I may be able to introduce them.

Coffee, cocoa, coca and rice will, I believe, form the principal products of the Colony, and with judicious management rich harvests should be reaped. The climate here is especially adapted to the cultivation of coffee, which bears enormous crops without any trouble and very little expense.

Tea would, I believe, grow luxuriantly on the slopes, and is well worthy of a trial, although on account of the scarcity of labour it would never become a general industry, as it requires too much manipulation.

There are numerous other products found which are of immense value in the European markets, and when things are a little advanced I shall have time to look into the matter and report to you more fully on the subject.

As in every country, we have pests, and here ants are our greatest. To certain crops they do considerable damage, but if the land is well selected they can, with a little trouble and care, be so kept down that the damage done is trifling.

Timber.—With an outlet towards the Atlantic, the timber on the territory would become a source of great income. On walking through the forest I encountered immense trees of cedar, mahogany, "walnut" and rosewood. Some "walnut" trees near Metraro would give boards of about 15 to 18 inches wide, but with the present means of conveyance could not be exported. There must be a sufficient number of valuable trees growing within reasonable distance of the Perené and its tributaries to make lumbering an industry of great importance. Numerous other kinds of various qualities are found very suitable for boarding and general building purposes.

Nurseries.—I have now got about 10 acres of land cleared, and ground will soon be got ready for seeds of all kinds. At present I have coffee seeds sown, which should give about 80,000 plants, and with the extra seeds to be sown shortly will enable me to supply all demands for this season. A small bed of Huanuco coffee seeds sown last autumn have done exceptionally well, and I hope to be able to have the seedlings planted out for seeding purposes as soon as the rains commence.

The introduction of Blue mountain coffee seeds would be of the greatest benefit, and could be set apart and grown to supply seeds for colonists.

A little later on I may be able to collect plants and seeds and make an exchange with the authorities of the Botanic Gardens, Jamaica.

Dentville.—Not much can be said about this little town in the meantime, but I have every confidence in saying that it will rise to be a very important place as well as a very pretty one. Although it lies rather low and is inclosed by an amphitheatre of hills, a strong breeze blows up the valley of the Perené, and makes the temperature nice and bracing.

During the rainy season a little trouble was caused by malaria, due no doubt to the dampness and the thick forest around, but I am of opinion that this will disappear as it is opened out.

Besides the Indians' houses, I have erected two new ones, which will suffice for the housing of the present population.

The plaza, or square, is now marked off, cleaned, and ready for buildings, and in due time the ground will be laid out with the necessary walks and beds.

Along the river bank, for about two miles, a splendid drive or walk can be laid down with very little expense, as the place abounds with palms and other ornamental trees, and I hope in due time to take this in hand.

Roads and Bridges.—In spite of the great difficulties to be contended with, I have great pleasure in saying that this important work is being carried on quickly. It is of the utmost importance to the rapid development of the Colony that special time and money be devoted to this great task, as without means of conveyance into the interior we can never expect to make any marked headway.

The road that is be constructed between Perené and Dentville is an excellent one, and when completed will be of the greatest importance to the Colony. Not only will it be a great highway into the interior, but vast tracks of valuable lands on both sides of it can be colonised.

The river communication is only open for a few months in the year, and no dependence can be put on the Indians for supplies or taking away produce. They dislike hard work of any kind, and having their own little affairs to attend to, no reliance can be placed on their services; also I may add that the navigation of the river to Dentville is so dangerous that balsas with cargo run a risk of getting upset on the journey down.

The bridges are also being pushed on, and in about two months I expect to see the bridge over the Paucartambo completed.

Prospects.—From an agricultural point of view the prospects of the Colony are very encouraging, and the colonist, notwithstanding the difficulties of establishing himself, will find his labours amply rewarded.

The man who is afraid of hard work need never come here, as an idler cannot get on in this country.

To men with a little capital this territory presents a field unsurpassed in any part of the world, and with roads a little more advanced hundreds of colonists can be settled within easy reach of the markets.

Every kind of produce sells readily, as the demand far exceeds the supply.

In concluding, I would add that all that is required to make this a great Colony is the emigration of colonists with a little means to give them an interest in their estates.

I remain, &c.
(Signed) Jas. Robb.

P.S.—I omitted to say, under the heading of "Nurseries," that one crop of rice and two crops of maize were raised at Dentville, as an experiment, with complete success.

In my next report I shall be able to deal more fully with these matters.

R. F. Mackenzie, Esq.,
Perenc.

J. R.

CCCXLVII.—HORTICULTURE IN CORNWALL.

The Cornish peninsula has a climate which in many ways lends itself to open-air gardening. The isotherm of 52° follows closely the contour of the coast. The winters are mild, frost is rare, and snow almost unknown; on the other hand, the summers are usually cloudy and rarely hot. These are precisely the conditions that the New Zealand type of vegetation peculiarily delights in; they are to be met with to some extent in Scotland, but scarcely at all in the east of England, where many Himalayan and New Zealand plants can only be grown with difficulty out of doors, and not always with success owing to the dryness of the summer air under glass.

The Assistant Curator of the Royal Gardens, Mr. Watson, and the Foreman of the Arboretum, Mr. Bean, spent a portion of their leave last autumn in the west of England. The following note, by Mr. Watson, gives some account of their visits (September 23–26) to a few representative gardens in South Cornwall, and affords a fairly representative picture of the possibilities of Cornish horticulture. It is substantially the same as that which appeared in *Garden and Forest* for October 25 last:—

The gardens in the south of Cornwall have a special attraction for horticulturists, many plants thriving out-of-doors there which in other parts of England must be grown under glass. The following notes were taken during a three days' ramble in the neighbourhood of Falmouth in September.

Himalayan rhododendrons are a feature of open-air gardening in South Cornwall. In several gardens near Falmouth, notably that of Mrs. Shilson, at Tremough, there is a large collection, and all the best known species are represented by enormous specimens. Another fine collection is that at Carclew, the residence of Colonel Tremayne, where, also, there are very fine examples of rare *Coniferæ*. There are also many large specimens of rhododendron and other tender shrubs and trees in the garden of Miss Fox at Penjerrick. Falmouth is exceptionally favoured in regard to climate, and, apparently, also in regard to suitable soil for these Himalayan rhododendrons.

I was informed by Mrs. Shilson's gardener, Mr. R. Gill, that eight degrees of frost is about the average maximum of cold experienced in the neighbourhood of Falmouth, and that heavy mists and rains occur frequently at all seasons of the year. Mr. Fox, of Grove Hill, obtained the Banksian medal about 30 years ago for "acclimatizing" upward of 200 foreign plants.

The Himalayan rhododendrons at Tremough are nearly all veterans, having been raised from seeds obtained from Kew soon after their first introduction by Dr. Hooker, now 40 years ago. They are now almost the sole occupants of very large shrubberies and spacious beds in various parts of a large garden, and there are also numerous specimens among the trees in the woods which partly surround the place. I measured some of the largest specimens. *R. arboreum*, trees 30 feet high, with trunks a foot in diameter; *R. niveum*, perfect, spherical bushes 12 feet high; *R. Falconeri*, 12 feet high, a grand specimen well furnished with large leathery leaves, a striking object at all times, but a magnificent sight when bearing scores of large trusses of flowers, as it does annually here; *R. barbatum*, 10 feet high, and furnished with branches down to the ground; *R. campanulatum* (*Wallichii*), abundantly represented by very large bushes; *R. ciliatum*, the largest plants I have ever seen, a bush six feet high and at least twice as much in diameter; *R. aboreum roseum*, *R. Shepherdii*, *R. cinnamomeum*, a variety of *R. arboreum*, and *R. Thomsoni*, all much larger than we are used to see them even under glass. A hybrid between *R. Thomsoni* and *R. barbatum*, raised in this garden, and named *R. Shilsoni*, is similar to the former in leaf and habit, differing only in the size of its heads, the colour of the flowers, and the shortness of the flower stalks, in which characters it is superior to *R. Thomsoni*, which is saying a great deal. *R. griffithianum* (*Aucklandii*), a delicate species as a rule, is in rude health and 10 feet in height. Seedlings are to be seen springing up in those parts of the garden which escape the hoe. In all the species there is considerable variety observable in the foliage and habit of the many representatives. This variation is due to the plants having all been raised from imported seeds, and not propagated by grafts or cuttings as is usual with garden rhododendrons. *Azalea indica* is as plentiful and large as the common Cherry Laurel is in northern gardens, while camellias occur frequently, and always in good health. As a rule, perfect flowers are cut from them for decorations at Christmas. At the time of my visit, the Belladonna Lily was the glory of the garden. Among the rhododendrons, along the carriage drive, against the terrace wall, and even in the kitchen garden, the flowers were as thick as cowslips in an English meadow. In the same garden a great bed on a large open lawn was filled with *Yucca gloriosa* and *Y. recurva*, about 30 plants altogether, with rosettes of healthy leaves a yard high, and each bearing a spike another yard high, clothed with white waxy bell flowers. They were a fine picture. Against the entrance, with its roots half choking a stream beside which it had been planted, stands a fine example of *Aralia* (*Dimorphanthus*) *mandshurica*. It is 30 feet high and 35 feet in the spread of its branches, its stem nine inches in diameter, and its flowers and fruit abundant. A few yards further on we saw a cottage almost entirely enveloped in a thick cloud-like mass of *Solanum jasminoides*, partially hiding the roof, and even the chimneys with its healthy green leaves and thousands of clusters of white starry flowers. This and the hardy fuchsias (*F. globosa* and *F. coccinea* chiefly) are favourities with the cottagers in Cornwall, where we saw many beautiful effects made by one or the other, and sometimes by the two combined, as they grew against the cottages by the roadside.

In Colonel Tremayne's garden *Rhododendron arboreum* is even larger than the largest at Tremough, having a stem four feet in circumference, while *R. Hodgsoni* is a great bush 15 feet through. *R. Falconeri* is 20 feet high, and this summer bore 96 trusses of flowers. I have never seen a more charming garden than this at Carclew; indeed, I question if there is anything better in Cornwall. The *Coniferæ* are magnificent: *Abies Smithii*, 80 feet high; *Tsuga albertiana*, the same; *Pinus patula*, a magnificent example; *Pseudolarix Kœmpferi*, the Golden Larch, is 30 feet high, and would have been much higher had not its top been broken off by a storm a few years ago; its trunk is exactly 18 inches in diameter. *Phyllocladus rhomboidalis*, the celery-topped pine, is represented by a handsome specimen 15 feet high. An interesting feature of this garden is the Lucombe Oak, of which there are numerous very large trees, 90 or 100 feet high, with trunks as straight as pines and measuring 12 feet in circumference. The Lucombe Oak (Lucombe was gardener at Carclew) is an accidental hybrid between the Cork Oak and Turkey Oak. There are also in this garden a number of hybrids between other oaks. Of the genus *Pinus* there are rare species from Mexico, India, and California. Loudon described many plants flourishing at Carclew as of quite unusual dimensions and habits. Enormous bushes of Leptospermums, *Embothrium coccineum*, Azaras, *Berberis japonica*, var. *Beali*, a grand shrub, and *Benthamia fragifera*, a common tree covered with its large strawberry-like fruit, are among the many things I noted· A path bordered by clumps of Himalayan rhododendrons, white *Azalea indica*, *Azalea mollis*, and *Embothrium* must be a beautiful picture in May or June when they are in flower. Among many features of interest noted in the glasshouses two call for special mention. First, a collection of seedling Dipladenias, all from seeds of *D. Brearleyana*, and showing wide variation of colour, from pale rose to cerise and purple. They varied also in the size and form of the flowers, and indicated that a great deal might be done with Dipladenias if the seeds of the garden varieties were sown. The second feature is *Cæsalpinia* (*Poinciana*) *pulcherrima*, which is rarely seen in bloom in England, but which is flowered every year at Carclew by keeping it potbound and training its branches against the glass in a sunny stovehouse. *Myrtus Ugni* is grown as a kitchen garden plant, its fruits being made into jam.

At Enys, the well-wooded demesne of the old Cornish family of that name, there are some interesting and rare New Zealand trees and shrubs; among others, *Fagus Cunninghamii*, 20 feet high; Pittosporums, 30 feet; several species of *Eucalyptus*, a fine bush of *Olearia argophylla*, the musk tree; another of *Laurelia Camphora*, while the handsome Chilian *Lomaria procera*, with fronds as large and rigid as a *Zamia*, is common and apparently naturalised in the garden. *Photinia serrulata* is 30 feet high and 20 feet in diameter, with a trunk a foot through. *Myosotidium nobile*, a rare and handsome herb from New Zealand, is represented by a large clump suggesting a good stool of rhubarb; the leaves are crowded on stout stalks, the largest over a foot in diameter. *Desfontainea spinosa* is a common bush in the garden and is nearly always in flower. *Magnolia lenniana*, a variety of *M. conspicua*, was in flower, and is a very handsome plant, the flowers being large and of a rich claret-red colour. *Leptospermum scoparium* is a tree 15 feet high, and when in flower is like a pillar of snow. The woods are rich in big specimens of Turkey Oak and fine Silver Firs, some of them 120 feet high, with grand mast-like trunks. *Cupressus macrocarpa*, the pride of Cornish and Devon gardens, is represented at Enys by enormous trees, one I measured having a trunk 3½ feet in diameter. A lake among the trees in the lower part of the garden is very picturesque, being surrounded by suitable reeds, ferns, &c., while the banks are covered with a thick mass of *Primula japonica*. This plant has taken entire possession of the whole of the margin of the lake, and would, if allowed, soon obliterate the paths, seedlings coming up in dense turf-like masses all over the gravel. In early summer when this crimson primrose is in flower it must be very fine.

In the gardens at Menabilly, the seat of Jonathan Rashleigh, Esq., there are many rare and fine examples of Coniferæ. I saw *Athrotaxis laxifolia*, 15 feet high; *A. imbricata*, 9 feet high; *Pinus oocarpa*, 20 feet high, a broad thick-stemmed specimem ; *P. parviflora*, 9 feet high, said to be the largest example of this rare pine in the United Kingdom. *P. Montezumæ*, 20 feet high, and as wide; *Picea ajanensis*, *P. webbiana*, *Abies grandis*, and *A. Pindrow*, each in fine vigorous health, and about 20 feet high, while a beautiful little specimen of *A. religiosa* is nine feet high. *Retinospora leptoclada* is seven feet high. The genus *Podocarpus* is also represented by large examples. It will afford some idea of the suitability of this garden for conifers if I give the measurements of a pair of *Pinus insignis* which were planted in 1838 by Mr. Rashleigh. These are now 70 feet high, with trunks four feet in diameter.

Escallonias are notable sea-side shrubs, and in some parts of Cornwall *E. macrantha* is an admirable hedge plant. The large waving plumes of the beautiful bamboo, *Thamnocalamus Falconeri*, occur in many places in Mr. Rashleigh's garden, and always with telling effect. Indeed, these and thousands of bushes of *Hydrangea hortensis*, all bearing big bunches of rich blue flowers, are special features at Menabilly. An avenue planted with Yuccas, *Chamærops Fortunei*, and bamboos will be very effective in 15 or 20 years. The true *Cordyline indivisa* is here represented by large specimens with stems six feet high, bearing large heads of leaves six inches wide and three feet long, their colour yellowish-green, with brown stripes. The lawns are full of daffodils and other spring-flowering bulbs, the woods carpeted with hardy Cyclamens, and everywhere there are big bushes of Himalayan rhododendrons. The Chilian *Raphithamnus cyanocarpus*, a myrtle-like bush 12 feet high, was laden with bright China-blue fruits. Callistemons, Hakeas, Eurybias, *Embothrium*, Pittosporums, and even Acacias, are all represented by big bushes. *Litsea reticulata* is a tree 30 feet high, and *Rhododendron Falconeri* a magnificent specimen. *Abutilon vitifolium album* is at home on the lawn, forming a large shrub, and flowering freely in summer. Where it is happy, this is one of the most beautiful of all Malvaceous plants. On one side of the garden there is a valley, one side of the slopes of which is planted with many rare Coniferæ, and other trees and shrubs, obtained chiefly from Kew, Mr. Rashleigh having always maintained an active correspondence with the Royal Gardens. This slope has been named the "Hooker Grove," in compliment to Sir Joseph Hooker.

There are so many choice and tender plants in these Cornish gardens that one wishes to see many of the newer things tried there. So far as I could understand the conditions, they are favourable to nearly all the plants that can be cultivated in the open air in England, and also to a great many which, even at Kew, have to be grown under glass. Cornwall might easily be made a gardener's paradise, and there are, no doubt, many other places in the world where a little gardening enthusiasm, rightly applied, would add materially to their beauty and interest.

CCCXLVIII.—BOTANIC STATION, DOMINICA.

The *Kew Bulletin* for June contained a note on the work of the Botanical Station, Dominica. The following interesting letter from the Curator gives a very satisfactory report of its progress:—

CURATOR, BOTANICAL STATION, DOMINICA, to ROYAL GARDENS, KEW.

Botanical Station, Dominica.
19th September 1893.

SIR,

I BEG to acknowledge the receipt of several numbers of the *Kew Bulletin*, also a box containing a sucker of *Musa sapientum* var. *rubra*, and 200 seeds of *Raphia vinifera*.

I have also received viâ Antigua seeds of *Uncaria Gambier* and 21 other plants, being part of a consignment sent from Kew. Amongst the latter I have four plants of *Erythroxylon Coca* (true) Ceylon, *Zizyphus Jujuba*, and other interesting plants.

Some of the plants sent to me from Kew last year are doing very well. *Sandoricum lucidum*, a fruit-tree from Singapore, is now seven feet high. *Anamirta Cocculus* is growing freely; *Spondias borbonica*, *Croton Tiglium*, and *Garcinia Mangostana* are all doing well, and many of the others are becoming established, and I hope will grow freely now. I have, unfortunately, lost the plant of *Cephäelis Ipecacuanha*. I greatly regret the loss of this plant, which was caused by the carelessness of the weeders. I hope Kew will be able to supply me with another plant.

You will be pleased to hear that the *Uncaria Gambier* is going to flower. On the large plant, which is now eight feet high, I counted 18 flower heads; the smaller plant only shows one flower head at present. I shall pay great attention to the plants, and if successful in obtaining seeds shall try my utmost to be successful with them.

I have recently been on a visit to Montserrat. During the week I visited the estates owned by the Montserrat Lime Company. Mr. Hamilton kindly showed me over the estates. The coffee cultivation is splendid. There are over 80 acres planted. The greater part is now bearing a fine crop. I strongly urge on planters, especially those who are taking up the cultivation of coffee, to visit Montserrat and note the kind of land selected and other points of value, and see what can be done by good cultivation. The cacao cultivation is very good. They are fortunate in possessing a very fine variety. It is robust, comes in bearing early, is most prolific and excellent in quality, good points not often combined in a single variety of cacao. I am glad to inform you that this variety is also being cultivated in Dominica, a large number of pods having been supplied through the Botanical Department direct to the planters, while all the plants sold from the station are raised from seeds purchased from the Montserrat Company. I also noticed several large fields under arrowroot cultivation.

The lime-tree does not seem to thrive so well in Montserrat as in Dominica. It is stated that the acidity of the Montserrat lime is greater than the Dominica lime. The Montserrat lime is small compared with the lime grown here. The trees here grow to a large size, and the crop borne is amazing. Even allowing for the greater acidity of the Montserrat lime, there can be no doubt that owing to the large size of the tree and fruit, and the immense bearing qualities, lime cultivation in Dominica must be more profitable than elsewhere. I also saw the fumigating process now adopted to free the scale insects from the lime trees. It is known as the Californian process, and has been fully described in the *Kew Bulletin*. It may have to be introduced in Dominica sooner or later. Mr. Hamilton kindly showed me a coffee-pulper by Gordon & Son, and explained its working.

I was very pleased to have the opportunity of seeing some first-class cultivation.

We have had an exceedingly wet season, and it is most difficult to keep the station in order. The plant sales continue good; the total number of plants sent out from January to middle of September just exceeds the total number sent out during the whole of 1892. If the sales continue good during the remainder of the year I shall be able to show a considerable advance on last year's plant sales.

I am, &c.
(Signed) J. JONES.

CCCXLIX.—ST. VINCENT ARROWROOT.

The following communication is supplementary to the article which appeared in the *Kew Bulletin* for August last (pp. 191–204) :—

MR. F. WATTS to ROYAL GARDENS, KEW.

Government Laboratory, Antigua,
December 12, 1893.

DEAR SIR,

I NOTE in the *Kew Bulletin* for August 1893, an account of the arrowroot industry in St. Vincent, and certain investigations in connexion therewith. Perhaps the following information, which is not contained in the *Bulletin*, may prove useful:—

Some time ago, I made an analysis of the ash of ripe arrowroot, and found that the fresh root, when cleaned and scaled, yielded 1·219 per cent. of pure ash, *carbon dioxide being deducted*. This ash contained:—

Silica - - - -	9·73
Phosphoric anhydride - -	12·24
Sulphuric anhydride - -	6·39
Chlorine - - - -	6·48
Oxide of iron - - -	·22
Alumina - - - -	·13
Lime (C_aO) - - -	3·18
Magnesia - - - -	5·39
Potash - - - -	54·06
Soda - - - - -	2·14
	99·96

From this I estimate that a fair crop of arrowroot would remove from the soil about 80 to 90 lbs. of potash per acre, which I think would be a serious drain unless this is supplied by manures. And this is the more important as my analyses of St. Vincent soils, like those of Mr. J. Hughes, point to a deficiency of potash, phosphates, and nitrogen.

The amount of phosphates removed by a crop would be small, and that of the lime almost negligable.

It would seem, therefore, that a chemical manure for arrowroot should supply 80 lbs. of potash per acre, with a relatively small amount of phosphate and nitrogen, and perhaps the amount of potash in the manure suggested by Mr. Hughes (*Kew Bulletin*, August 1893, p. 199), might be increased (perhaps *doubled*) with advantage.

Believe me, &c.
(Signed) Francis Watts.

CCCL.—COFFEE-LEAF DISEASE IN CENTRAL AFRICA (PREVENTIVE MEASURES).

Foreign Office to Royal Gardens, Kew.

Sir, Foreign Office, September 16, 1893.

I am directed by the Earl of Rosebery to transmit herewith an extract of a Despatch from Her Majesty's Commissioner in Central Africa, enclosing regulations which he proposes to issue prohibiting the importation into British Central Africa of any seeds or plants likely to introduce the leaf disease of the coffee shrub.

Lord Rosebery would be glad to be favoured with any observations which the Director of Kew Gardens may have to offer upon these papers.

I am, &c.
(Signed) P. W. Currie.

The Assistant Director,
Royal Gardens, Kew.

Extract.

I have the honour to submit to your Lordship for approval and sanction the following regulations prohibiting the importation into British Central Africa of any seeds or plants likely to introduce the leaf disease of the coffee shrub into British Central Africa.

In April last I was approached on this subject by the Planters' Association of the Shiré Highlands. It was pointed out to me that the introduction of the leaf disease of Ceylon into the coffee plantations of Central Africa would simply ruin the commencing prosperity of the country, inasmuch as coffee is the one source of wealth which this Protectorate possesses.

Royal Gardens, Kew, to Foreign Office.

Royal Gardens, Kew,
September 16, 1892.

Sir,

I have the honour to acknowledge the receipt of your letter of yesterday's date, enclosing an extract from a Despatch from Her Majesty's Commissioner in Central Africa respecting regulations proposed to be issued for the purpose of preventing the introduction of leaf disease in coffee.

2. I do not think that Mr. Johnston puts the matter at all too strongly when he states that if such a calamity were to happen "it "would simply ruin the commencing prosperity of the country."

3. The subject of leaf disease in coffee has engaged the continuous attention of this establishment almost since its first appearance in the East. At present the coffee-growing countries of the New World are, as far as is known, entirely free from it. Strenuous measures have been taken by the Colonial Office, acting under the advice of this establishment, to prevent its introduction into the West Indies.

The following extract from a letter addressed by Kew to the Colonial Office, December 8, 1890, will be found, perhaps, useful to Lord Rosebery as a summary of the present history of the subject :—

"3. As you are aware, the subject of the diseases which affect the coffee plant in different parts of the world has received very attentive consideration at Kew. It appears to me that it is desirable to examine the present condition of the question as regards Jamaica with some care, as there are in the papers which you have transmitted to me some rather serious misconceptions about it.

"4. As is well known the leaf disease of the coffee which has proved so disastrous to its cultivation in Ceylon is due to the attacks of a microscopic fungus, the spores of which it has been shown are carried by the atmosphere with great facility, and which, therefore, spreads with frightful rapidity in a country where large tracts are devoted to coffee cultivation. All the evidence seems to point to the fact that this fungus, which before it made its appearance on a large scale amongst coffee in Ceylon was unknown to science, is a species endemic to the island. Like thousands of other microscopic leaf-fungi, it probably maintained its existence in an unconspicuous manner in some native Rubiaceous plant (*i.e.*, belonging to the same family as the coffee). It was probably only by a kind of accident that about 1869 it found a suitable host in cultivated coffee, and thus was enabled to develop itself on a scale which speedily made it a scourge.

"5. I can hardly doubt that it was from Ceylon that it was almost immediately conveyed to Southern India, to Sumatra (1876), Java (1879), and Mauritius (1881). It is also practically certain that it was directly introduced into Fiji from Ceylon. Dr. MacGregor, who was charged with the duty of attempting to stamp it out in Fiji, reported July 26, 1879, to the Lieutenant-Governor: 'Probability is pretty 'strong that the disease was introduced in, and spread from, the 'charcoal packing of imported seeds. . . . . It is, however, by 'no means impossible that the disease was introduced in the clothing 'or personal effects of some person or persons arriving in Fiji from 'Ceylon.'

"6. On July 1, 1884, Sir Joseph Hooker informed the Colonial Office that the disease had made its appearance in Natal. In what manner the infection had been brought about has not, as far as I know, been ascertained.

"7. It is, however, clear that, starting from Ceylon, a wide area has been progressively infected, extending, at the present time, from Natal in one direction to Fiji in the other. Within this area it can hardly be doubted that the disease has been disseminated to countries and places where no one has been at the pains to record its occurrence.

* * * * *

"14. The *Hemileia* is without exception the most destructive fungoid scourge known. It exceeds even the potato disease, because that does not ravage the crop with persistent violence year by year. The *Hemileia*, on the other hand, when it has settled on a plantation, remorselessly, if somewhat slowly, destroys it. Its action has necessarily largely restricted coffee cultivation to the Old World, and to that extent the risk of transporting it which attends the abundant communication which now takes place between individual colonies is diminished. Still, sooner, or later, the spores will probably be carried across the Atlantic. In the meantime it appears to me to be the interest of every uninfected coffee-growing country to intercept its invasion."

4. It will be seen that with the exception of tropical Africa the whole coffee-growing area of the Old World is now infected.

5. I fear that the introduction of the scourge into Central Africa is only a question of time. Should such a calamity occur its consequences might be mitigated if coffee cultivation were not carried on over large continuous stretches of land, but the plantations were kept separate by belts of trees to windward. The spores of the fungus are carried readily by the wind. When a plantation is infected it may be cleansed and the fungus in its nascent state destroyed by powdering the trees with a mixture of lime and sulphur, but unless the access of fresh spores can be arrested, the plantations may be readily re-infected when the lime and sulphur is washed off by rain. The presence of belts of trees would mitigate this by arresting the spores.

6. I am always reluctant to concur in regulations which must have a restrictive effect, even if small, on commercial enterprise. But in the present case it is impossible to accept the risk of ruining an important and developing industry, which is an important factor in the successful colonisation of British Central Africa. It appears to me that Her Majesty's Government have no choice but to follow the precedent already set in the case of Jamaica.

7. The proposed regulations will, however, require revision. As already pointed out, the whole of the New World is free from leaf disease. South America need not therefore be included. On the other hand, the *whole* of the coffee-growing countries of the Old World appear to be infected. To be of any use, the regulations must include Mauritius, the Straits Settlements, Java, Sumatra, and the Dutch East Indies, as well as the Malayan region generally.

Zanzibar is, no doubt, included as a general *entrepôt* from the East. The weak point in the defence is undoubtedly Natal. Coffee cultivation is carried on there, I believe, on only a small scale, and it is almost inexplicable how it can have become infected. A case like this, I confess, leads me to take a gloomy view of the whole position, and to incline to the belief that sooner or later the disease will establish itself through the coffee cultivation of the whole world despite every precaution. The severest restrictions did not prevent the Phylloxera being introduced from Europe into South Africa, even though a competent scientific opinion had been given to the effect that the passage of the Equator would be a natural bar to its southern dispersion.

I may add that I have no evidence on the point, but think it extremely probable that Madagascar is infected.

I am, &c.
(Signed) W. T. THISELTON-DYER.

Sir Philip Currie, G.C.B.,
Foreign Office,
Downing Street, S.W.

CCCLI.—WEST AFRICAN BOTANIC STATIONS.

The volumes of the *Kew Bulletin* since 1888 contain numerous notices of the progress of the attempts made by means of the Botanic Station system to develop the material progress of the West African Colonies.

These attempts were at first necessarily in great measure tentative and experimental. They have now attained a sufficient measure of success to cause the Stations to be regarded as institutions of permanent usefulness. The following correspondence places on record the official action which has taken place in consequence :—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, September 25, 1893.

AFTER the recent meeting of the four West African Governors at the Colonial Office, which you and Mr. Morris were kind enough to attend, and at which the steps to be taken for extending the Botanic Station System and developing technical education in those Colonies were discussed, a memorandum was drawn up embodying the conclusions arrived at on that occasion.

I am now directed by the Marquis of Ripon to enclose for record in your Department, a copy of this memorandum, and I am to state that his Lordship approves of the suggestions contained therein.

I am, &c.
(Signed) JOHN BRAMSTON.

The Director,
Royal Gardens, Kew.

The Development of the Botanic Station System and of Technical Education in the four West African Colonies.

At a conference of the four West African Governors, the Director, and Assistant Director of the Royal Gardens, Kew, which was held at the Colonial Office on the 12th of September 1893, it was decided that it was desirable that :—

(1.) The Curator of a Botanic Station should be made a permanent official.

(2.) His salary should be 200*l.* a year, rising by annual increments of 16*l.* 13*s.* 4*d.* to 250*l.* a year.

(3.) He should receive travelling allowance according to his rating.

(4.) He should be entitled to the benefit of the Colonial Regulations regarding the leave, passages, pensions, &c. of West African Officials.

As regards *Training in Agriculture*, it was agreed that the following course should be adopted as far as possible :—

(*a.*) *Training Lads at Botanical Stations.*—This might be regarded as a first step in the direction of teaching boys in agricultural pursuits. Intelligent boys should be attracted to the work under a definite arrangement made with the Government for their future career. The lads might receive a small sum at first towards their maintenance, to be gradually increased year by year as they improved. The training should be thoroughly practical and suited to the circumstances of the Colony. Of these lads the best might be selected for further training in the West Indies or at Kew. When qualified the trained lads might be employed (1) as officers in charge of branch botanic stations; (2) as managers of private plantations; (3) as instructors in agriculture in schools; (4) to replace the Curator when occasion may require. The number of lads in training should be regulated by the capacity of the Station. The Curator should not be burdened with the board and lodging of the lads. The arrangements for training should be entirely in the hands of the Curator. It will probably be found best to place each lad singly under the training of one of the workmen, and move him from one kind of work to another, as circumstances arise. The whole training should extend over four or five years at least.

(*b.*) *Branch Botanic Stations.*—As circumstances demand branch stations might be started in various parts of the Colony. These could be placed under charge of trained natives supervised by the Curator from head quarters. These branch stations would become in time valuable agencies for the diffusion of agricultural knowledge, they would act as depôts for plants sent from the Chief Botanic Station; and they might devote attention to the special kinds of products suited to the district in which they were placed.

As regards *Instruction in Handicrafts* it was agreed that no general scheme could be devised, but that each Governor would submit a scheme adapted to the requirements of his Colony as soon as possible after his return.

(Signed) W. Brandford Griffith.
W. Fleming.
G. T. Carter.
R. B. Llewelyn.

A step had already been taken in the Colony of Lagos to train young African lads so as to fit them for such duties as the charge of branch botanic stations. In this, as in so many other matters likely to conduce to the development of the West African Colonies, Sir Alfred Moloney, the Governor of Lagos, took the initiative. Two young men, Thomas B. Dawodu and Ferdinand G. Leigh, were sent in October 1890 to the Botanical Department, Jamaica, for training, and in April of the present year were transferred to Kew. They evince considerable aptitude for horticultural work, and it is hoped will be returned to the Colony with a sound and professional knowledge of the general principles of cultivation and of all that relates to plant propagation.

The progress of the Botanical Station on the Gold Coast has been recorded from time to time in the *Kew Bulletin* (see *infra*, pp. 160–62). The Curator, now on leave (see *infra*, p. 66), has accompanied the Governor, Sir Brandford Griffith, on a visit to the West Indies, which cannot fail greatly to enlarge his experience.

The following extracts from his report for the period ending June 30 last, afforded satisfactory evidence of the work which has been accomplished at the station. The plants now experimentally introduced can hardly fail to lay the foundation of many important future industries.

"The whole of that portion of land between the Banana Walk on the west, and the Akropong Road on the east, has been planted with Arabian Coffee.

"The piece of land situated near the town of Aburi, on the Akropong Road, which was cleared in December last, has been planted with Liberian Coffee, and the boundary of Cocoa-nuts completed around it.

"All the land extending from the west end of the house and to the right of the road leading to Aburi, has been completely planted with Cacao.

"Besides the above, a large number of other valuable economic plants and fruits have been planted out into permanent places. Some of the most valuable of these plants are the following:—

18 plants of *Hevea spruceana*. This plant is the source of the valuable British Guiana rubber. 'Fine Para is the standard by 'which all other grades are measured; it brings the best price, and 'probably is used more than any other;'

12 plants of *Castilloa elastica* or Central American rubber. This tree produces the rubber of British Honduras, Nicaragua, Guatemala, Mexico, and Guayaquil;

- 6 plants of *Artocarpus integrifolius*—the Jack fruit;
- 12 plants of *Achras Sapota*—the Sapodilla, a valuable West Indian fruit;
- 4 plants of *Cinnamomum zeylanicum*—the bark of which produces Cinnamon;
- 6 plants of *Caryophyllus aromaticus*—the dried unexpanded flowers of which produce the Clove;
- 6 plants of *Eugenia Pimenta*—the dried unripe fruit of which produces Pimento, or Jamaica Pepper, also known as Allspice;
- 6 plants of *Myristica fragrans*—the Nutmeg;
- 4 *Chrysophyllum Cainito*—the Star Apple;
- 8 *Anona squamosa*—the Sweetsop;

and a large number of other plants.

"All plants previously planted out have made a marked improvement during the last six months. They have grown luxuriantly, and many have borne fruit.

"*Coffee.*—Both the Liberian and the Arabian varieties are bearing their first crop of berries. The trees are in a most healthy and robust state, and give promise of a good crop.

"*Cacao* is also doing very well. I have already gathered more than 100 pods, which have been utilised for seed, most of which have germinated satisfactorily. The trees are again bearing heavy crops."

CCCLII.—MISCELLANEOUS NOTES.

Mr. HENRY JAMES DAVIES, a member of the gardening staff of the Royal Gardens, has been appointed a gardener for service in the Royal Botanic Gardens, Calcutta and Darjeeling.

Mr. JOHN ROBERT WARD, a member of the gardening staff of the Royal Gardens, has been appointed Superintendent of the Public Gardens at Nagpur, Central Provinces, India.

Mr. WILLIAM LUNT, a member of the gardening staff of the Royal Gardens, has been appointed, with the approval of the First Commissioner of Her Majesty's Works and Public Buildings, botanical collector for Kew to Mr. Theodore Bent's expedition to the Hadramaut Valley in South Arabia. The flora is only conjecturally known, and no botanical collections appear even to have been made in it. The expedition left London on November 24th, and is expected to return about April of next year.

It is with great regret that intelligence has been received at Kew of the abolition by the Government of Queensland, amongst numerous other posts, of that of Colonial Botanist, held by Mr. FREDERICK MANSON BAILEY, F.L.S. Mr. Bailey is held in high esteem in the Colony, and "strong efforts were made to induce the Government to "reconsider their decision so far as the Colonial Botanist was "concerned." Mr. Bailey was one of the recent explorers of the Bellenden-Ker range, and has contributed to Kew type-specimens of the numerous additions that he has made to the flora of Queensland, and indeed of Australia (*Kew Bulletin*, 1891, p. 275). The Colony is so largely dependent on its botanical resources that it cannot dispense with the services of a botanical expert more than temporarily. It is to be hoped that in the meantime the organisation of the Colonial Botanist's office will be maintained, and the valuable Government Herbarium properly cared for.

Dermatobotrys Saundersii.—This is a new and interesting genus of *Scrophulariaceæ*, which was created by Mr. H. Bolus from specimens supplied by Mrs. Katherine Saunders, of Natal, an old and valued correspondent of Kew. A figure and description of the plant were published in *Hooker's Icones Plantarum*, t. 1940. In 1892 Mrs. Saunders forwarded fresh seeds of it to Kew, and from these a large batch of plants were raised, which have since been freely distributed. Several of the plants at Kew are now in flower. They are about a foot high, branched, the stems succulent, the leaves fleshy, oblong-ovate, serrated, glabrous, with rose-tinted veins. The flowers are produced in whorls just below the new leaves, each flower being tubular, 1½ inches long, with five regular teeth, the colour outside bright red, the inside yellow.

The following information with respect to the habit and peculiarities of this plant has been supplied by Mrs. Saunders, from Eshowe, Zululand, June 27th, 1892:—

"Having been staying some time with my son, who discovered the *Dermatobotrys* you kindly named after him, I avail myself of the opportunity of being here in its flowering season, which has lasted already several weeks, to send more specimens of it. In the small box now posted with this, I send some roots of the *Dermatobotrys* which have been detached from the tree, upon which it is epiphytic. They are certainly different from the aërial roots of any plants I have seen. Although it grows normally upon trees, it also occurs growing on the ground. I have put in some ripe seeds, which I trust will enable you to introduce the plant into gardens at home, for it would be a great ornament to any garden, both flowers and foliage being handsome." Specimens of this plant in fruit only in the Kew Herbarium were collected by the late Mr. Gerrard in Natal 20 years ago.

Ilex paraguensis.—In the *Kew Bulletin* for 1892, p. 132, will be found some notes on certain plants yielding Paraguay Tea or *Yerba de Maté*, one of the most important economic products of South America. Until recently, the plant generally grown in gardens for *Ilex paraguensis* was *Elæodendron quadrangulatum;* this has large shining green laurel-like leaves, and is totally unlike the plant from which Paraguay Tea is obtained. In September last, Kew received, through the kindness of Señor Glaziou, Director do Passeio publico, Rio de Janeiro, seeds of the true *I. paraguensis*, some of which were sown and the remainder distributed to the following Botanical Gardens:—Antigua, Calcutta, Ceylon, Demerara, Edinburgh, Jamaica, Natal, Paris, Singapore, and Trinidad.

Palo Santo, or Holy Wood.—In the "Report for the year 1892 on the Trade of the Province of Santa Fé" [No. 1161, Annual Series, F.O., 1893, p. 4], Mr. Consul Bridgett furnishes a Table of Exports from Rosario, including a reference to Holly wood, of which 159 logs were exported during the year 1891–92.

As the museum collection did not contain a specimen of this so-called Holly wood from the Argentine, application was made through the Foreign Office to H.M. Consulate, Buenos Ayres, for a sample of the wood, together with flowers, fruits, and leaves, by which to identify its botanical source.

In response to this application information was received from Mr. Vice-Consul Mallet, British Vice-Consulate, Rosario, correcting the name Holly wood to that of "Palo Santo" or Holy wood, the error in spelling having occurred in a broker's list of exports, from whence the note in the table referring to this wood was obtained.

Subsequently, Mr. Vice-Consul Mallet forwarded a specimen of the timber which had formed one of the Argentine exhibits in the Paris Exhibition, 1889, but as no specimen of the plant could be obtained until the spring, the exact identity of the wood must remain yet undetermined, but judging from its structure and density it is doubtless furnished by a species of *Guaiacum*, and perhaps identical with Lignum Vitæ (*Guaiacum officinale*, L.)

The tree producing Holy wood is said to grow chiefly in "Chaco," and is used in the manufacture of furniture.

Pine apple Fibre.—This product has been noticed in the *Kew Bulletin* for 1887 (April), and 1893 (p. 208). A sample of excellent quality and extraordinary length, grown at Malacca, has been brought to this country by Mr. R. Derry, Assistant Superintendent in the Garden and Forests Department of the Straits Settlements. The following communication gives an estimate of its commercial value :—

Messrs. Ide and Christie to Mr. R. Derry.

72, Mark Lane, London, E.C.,
8th December 1893.

Dear Sir,

We have had to-day a call from our manufacturer, to whom we gave samples of your pine-apple fibre. Although his treatment of it is not completed yet, he is satisfied that he could use it in large quantities, say 1,000 tons a year or more, at a price of 30*l.* per ton in London. This may be some encouragement to you and your planter friends in the Straits Settlements to organise the planting of pine-apple to yield fibre on a commercial scale. Of course as you cannot make any engagement at present to deliver a reasonably large quantity within a period of six or twelve months, it is impossible to bring our friend to actual *business* just now. He tells us it is more difficult to bring this fibre to a spinning condition for fine yarns or fabrics than even Ramie or China Grass, but he thinks the results are good and would reward the care taken in its manufacture.

Yours faithfully,
(Signed) Ide & Christie.

Tibet.—Professor C. S. Sargent, Director of the Arnold Arboretum, Brookline, Massachusetts, has presented to Kew the plants collected and dried by Mr. W. W. Rockhill, formerly Secretary of the United States Legation at Pekin, on his last adventurous journey in Mongolia and Central Tibet. The collection consists of about 50 species, some of them probably undescribed. It will shortly be worked out and the results appended to Mr. W. B. Hemsley's forthcoming paper on the plants collected by Dr. Thorold, who accompanied Captain Bower on his equally memorable journey from Western Tibet to China.

Lagos.—Dr. Rowland has sent a further collection of about 300 dried plants, which, with previous collections recorded in the *Kew Bulletin* (1893, p. 146), have been approximately determined and the duplicates distributed to other botanical establishments with which Kew exchanges.

South Africa.—Mr. Harry Bolus, F.L.S., a resident near Cape Town, who has been some months at Kew studying his latest discoveries in connexion with the materials in the Herbarium, has presented a century of dried plants, consisting of new, rare, and interesting species, chiefly of his own collecting. The same gentleman has presented a copy of the first part of his illustrated work "Icones Orchidearum Austro-Africanarum." It contains 50, with few exceptions, coloured plates of South African orchids. The figures are excellent and the analyses of the flowers very complete.

From Mr. E. E. Galpin, of Queenstown, Kew has received a parcel of about 60 species of dried plants, including many of great interest, among them a flowering specimen of *Sterculia Murex*, described in the *Kew Bulletin* (1893, p. 155). A figure with a fuller description will shortly appear in *Hooker's Icones Plantarum*, t. 2278.

China.—Mr. T. L. Bullock, H.B.M. Consul at Newchang, has presented a collection of about 150 species from North China.

Smyrna.—From Mr. E. Whittall, Kew has received another century of dried plants sent chiefly with the view of a selection being made of such as were deserving of cultivation.

Malaya.—Mr. H. N. Ridley, F.L.S, the Director of the Gardens and Forest Department of the Straits Settlements, has sent a further collection of dried plants, numbering some 500 species; and Mr. Curtis, Assistant Superintendent at Penang, a collection of 100 species, partly from Siamese territory.

Pepper Cultivation.—Considerable difficulty appears to be experienced at the West Indies in the successful cultivation of pepper, for which a market might readily be found in the United States.

Mr. R. Derry, Assistant Superintendent, Garden and Forest Department, Straits Settlements, now in this country on leave, has supplied the following account of the method of cultivation pursued in the colony.

The method usually adopted with pepper in the Straits Settlements is as follows:—

Fruiting vines are set aside as stock plants for propagating. This is done by layering, but only strong branched shoots are selected, and all superfluous shoots are removed. It is necessary to be careful about the selection of shoots for layering, as certain shoots never produce fruit.

When rooted the young plants are transplanted to prepared holes, and, when the vine commences growing, posts are planted for support. Posts are preferred from large trees of durable wood, split up, about 10 feet long and about 10 inches wide, varying from ½ inch to 6 inches in thickness. The vines are carefully tied and trained on the posts, all superfluous shoots pruned until the plant reaches the top of the post.

When growing the plants are kept mulched with burnt earth, and dressed with liquid manures as soon as fruiting commences.

During hot weather the roots are protected with straw of some kind. The fruits are picked when red, and kiln dried.

R. Derry.

3rd November 1893.

Wattle Bark.—The cultivation of Wattles (*Acacia, spp.*) for the production of tanning barks at one time appeared to be likely to become a profitable industry in suitable climates. According to Maiden "'Wattles and Wattle-barks,' *Acacia saligna* in South-west Australia " is the principal source of tan bark, and is said to contain nearly 30 " per cent. of tannic acid." On the other hand *Acacia pycnantha* yields "one of the richest tanning barks in the world; a richer may exist, " but I do not know of it." A sample yielded 46 per cent. of tannic acid and ordinarily it appears to average from 35 to 40 per cent.

The cultivation of *Acacia saligna* in South Africa appears to have been unremunerative. Mr. D. E. Hutchins reports:—

"The failure of *Acacia saligna* bark on the London market is serious, and threatens to greatly reduce the profits on wattle-planting. I am not very sanguine that *A. pycnantha* will be able to replace *A. saligna*. The position, so far as my observations extend, seems to be that the growth of *A. pycnantha* is uncertain, and that although its bark is about twice as rich as *A. saligna*, the growth may be only about one half as rapid. On the other hand the vigorous and rapid growth of *Acacia saligna* will probably render it remunerative to grow in most cases as fire-wood. A native of Western Australia it finds in the Cape Peninsula a nearly identical climate, and flourishes like most of the other Western Australian species. Should the shipment of *A. saligna* continue to prove unremunerative, it will be necessary to try the manufacture of tan extract. Kutch-boiling is practised on a large scale in many of the forests of India and Burmah with very rude appliances."—(Extract from the Reports of the Conservators of Forests, Cape of Good Hope, for the year 1892.)

Strawberries in India.—According to Mr. M. A. Lawson, Government Botanist, Madras, strawberries grown in the Nilgiris revert to a feral form (*Kew Bulletin*, 1892, p. 106.) It is not easy to see why this should be the case if they are propagated from runners. A collection of seeds of the best kinds was procured and sent out to Madras, and Mr. Lawson records the results, which are so far satisfactory in the following extract from the Annual Administration Report of the Government Botanical Gardens and Parks, Nilgiris, 1892–93 :—

"The following varieties raised from seed obtained from Kew have produced fine fruit, and promise to do well on these hills :—*Sir Charles Napier*, *Waterloo*, *Crescent seedling*, *Duc de Malakoff*."

Gambia Native Medicines.—Mr. J. H. Ozanne, Travelling Commissioner for the Gambia, West Coast of Africa (who had been supplied with a botanical outfit from Kew), has sent a small collection of plants from the northern bank of the Gambia, accompanied by some brief notes on the medicinal uses of some of them. Though the plants and their uses are for the most part well known, it may be of some interest to record the identification of the native names with the species as determined at Kew.

The following are the principal plants referred to :—

Anona senegalensis, Pers. Called "Diorgud" by the natives. The leaf heated and soaked in water, is used in diarrhœa and for griping pains in the stomach. The petals of the flowers are used on the Niger for flavouring country dishes.

Cochlospermum tinctorium, Rich. "Foosca" of the natives. A decoction of the roots is given to assist women in labour. The plant is well known in the Soudan for a yellow dye obtained from the roots.

Sclerocarya, sp. It has not been possible to determine the species of this plant. By the natives it is called "Dib." The gum is dissolved and mixed with soot and used for ink. The fruit resembles a greengage, and the juice is boiled down to a thick black consistence, and used by the natives for sweetening their "cherree," or Guinea corn gruel.

Cassia sieberiana, D.C. A small tree, called by the natives "Guamgua." The root is steeped in water, and the infusion used to promote the flow of urine (yellow fever).

Combretum, sp. This plant, called by the natives "Topp," has not been specifically determined. The gum is used for the cure of toothache, and a decoction of the root is given to relieve pains in the stomach.

Sphæranthus hirtus, Willd. This is a common weed, called by the natives "Lookidge." It is gathered and spread thickly on beds on which sick persons are laid, as it is said to relieve pains in the body and limbs and to induce sleep.

Ocimum basilicum, L. A very common weed, much used by the natives, who soak it in water and drink the infusion for "cooling the blood."

Viticulture in Uruguay.—Mr. Vice-Consul Greenfell reports from Monte Video :—

During the last three or four years an increased interest has been shown in the cultivation of the vine, and it has assumed considerable proportions in the districts of Salto, Paysandú, and in the vicinity of Monte Video. The country generally is well adapted for the growth of the grape, but the wine manufactured as yet is not of a high-class character, and principally of the red description. Want of experience and knowledge of treatment may be the cause of this, but every effort is being made to improve the quality and extend the industry, for, on account of the high tariff on all imported wines, there is a ready demand for as much as can be produced.

The appearance of the phylloxera (*Phylloxera vastatrix*) has caused a certain alarm amongst the vine-growers, but stringent measures have been taken by the Rural Association to prevent the propagation of this justly-dreaded scourge of the vine. The spread of this pest would be a serious calamity for this country just at a moment when the wine industry is assuming important proportions, with every prospect of a wide development.

Hitherto the phylloxera has been unknown in Uruguay, and it has doubtless been introduced by plants or cuttings brought from countries where the plague existed. These are now strictly prohibited from being imported from Europe in either shape, with the hope of preventing, if possible, the further multiplication of the blight into the country.—(F. O. Reports, 1893, Annual, No. 1,294, pp. 10, 11.)

British Fungus-Flora.—Volumes II. and III. of this work (*see infra*, p. 26) have been published by Mr. G. Massee, Principal Assistant (Cryptogams) in the Herbarium of the Royal Gardens, and include the remainder of the *Basidiomycetes* and the whole of the *Hyphomycetes*. The three volumes contain full descriptions of 2,500 species, and generic types are illustrated by 340 figures.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX I.—1893.

LIST OF SEEDS OF HARDY HERBACEOUS PLANTS AND OF TREES AND SHRUBS.

The following is a list of such Hardy Herbaceous Annual and Perennial Plants as well as of such Trees and Shrubs as have matured seeds under cultivation in the Royal Gardens, Kew, during the year 1892. These seeds are available for exchange with Colonial, Indian, and Foreign Botanic Gardens, as well as with regular correspondents of Kew. The seeds are only available in moderate quantity, and are not sold to the general public. It is desirable to add that no application, except from remote colonial possessions, can be received for seeds after the end of March.

HERBACEOUS PLANTS.

Acæna macrostemon, Hk. f., Chili.
  microphylla, Hk. fil., N. Zealand.
  myriophylla, Ldl., Chili.
  ovalifolia, Ruiz et Pavon, Peru (Ancistrum repens, Vent.).
  pinnatifida, R. & P., Chili.
  Sanguisorbæ, Vahl, New Zeal.
  sericea, Jacq. f., Spain.

Achillea Ageratum, L., Europe.
  aegyptiaca, L., Eur., etc.
  decolorans, Schrad., Eur.
  ligustica, All., Eur.
  Millefolium, L., Eur.
  Ptarmica, L., Eur.
  setacea, W. & K., Eur.

Aconitum heterophyllum, Wall, India.
  Lycoctonum, L., Eur., etc.
  — var. orientale, Hort.
  Napellus, L., Eur., Temp. Asia.
  — var. album.
  volubile, Pall., Siberia.

Acroglochin chenopodioides, Schrad., W. Himal.

Actæa spicata, L., N. Amer.

Actinolepis coronaria, Gray, Calif. (Hymenoxys californica, Hook. Bæria coronaria, Gray. Shortia californica, Hort.)

U 74389. 1250.—12/92. Wt. 38.

Actinomeris squarrosa, Nutt., N. Amer.

Adenophora liliifolia, Bess., Hungary, etc.
(A. suaveolens, Fisch.)

Adlumia cirrhosa, Raf., Unit. States.

Adonis æstivalis, L., Eur.

Ægopogon pusillus, Beauv., Mexico.

Æthionema Buxbaumii, DC., Thrace.
græcum, B.S., Greece.
saxatile, R.Br., S. Eur.

Agropyrum dasyanthum, Led., Siber.
junceum, Beauv., Eur., etc.
(T. junceum, L.)
pungens, R., S. Eur.
— var. pycnanthum, Godr.

Agrostis alba, L., Eur.
— var. stolonifera, (L.)
interrupta, L., S. Eur.
rubra, L., Norway, Sweden.
vulgaris, With., Eur.

Ainsworthia cordata, Boiss., Asia Minor.

Alchemilla alpina, L., Eur.
argentea, Don., Eur. (A. conjuncta, Bab.)
vulgaris, L., Eur.

Allium angulosum, L., Siberia.
atropurpureum, W. et K., Hungary.
carinatum, L., Eur.
flavum, L., Eur.
giganteum, Regel., Siber.
globosum, Redouté., S. E. Eur.
— var. albidum.
hymenorrhizum, Ledeb., Siberia.
— var. tenuifolium, Regl.
odorum, L., Siberia.
narcissiflorum, Vill., Eur.
nigrum, L., Eur.
polyphyllum, Kar. et Kir., Siberia.
pulchellum, Don., Eur.
Schœnoprasum, L., Eur.
— var. sibiricum, (L.)
senescens, L., Eur., Siber.
subhirsutum, L., Eur.

Allium—*cont.*
urceolatum, Rgl., Turkest.
vernale, Tin., Eur.
Victorialis, L., Eur., Siber., etc.

Alopecurus agrestis, L., Eur.
geniculatus, L., Eur.
nigricans, Hornem., Eur.
pratensis, L., Eur.
— var. fol. variegatis.

Alstrœmeria hæmantha, R. et P., Chili.

Althæa ficifolia, Cav., Dalm., etc.
rosea, Cav., Eur.
sulphurea, Boiss. et H., Persia.

Alyssum argenteum, Vitm., Eur.
calycinum, L., Eur.
incanum, L., Eur.
montanum, L., Eur.
saxatile, L., Russia.

Amarantus caudatus, L., Spain.
chlorostachys, Willd., India.
hypochondriacus, L., Amer., etc.
— var. caudatus, (L.)
— var. speciosus, (Don.)
retroflexus, L., Amer., etc.

Amblyolepis (*see* Helenium).

Amsinckia intermedia, F. and M., N. Amer.

Anacyclus radiatus, Loisl., Eur.

Anagallis arvensis, L., Eur., etc.
— var. carnea, (Schrank.)
— var. cœrulea, (Schreb.)

Androsace nana, Horn, Eur.

Anemone baldensis, L., Eur.
coronaria, L., S. Eur., etc.
decapetala, L., N. Amer.
pratensis, Mill., Eur.
— var. montana, Hoppe.
Pulsatilla, L., Eur., etc.
rivularis, Buchan., Himal.
sylvestris, L., Eur.

Angelica dahurica, Benth. et Hook., Japan.

Anoda Wrightii, Gray, Mexico.

Antennaria dioica, Gærtn., Eur., etc.
— var. tomentosa.

Anthemis ætnensis, Schouw., Mt. Etna.
Bourgœi, B. et R., Spain.
Kitaibelii, Spr., Hungaria.
nobilis, L., Eur.
— var. discoidalis.
peregrina, Willd., S. Eur.
tinctoria, L., Eur.

Anthericum Hookeri, Colenso, N. Zeal.
Liliago, L., S. Eur., N. Afr.

Anthoxanthum odoratum, L., Eur.
Puelii, Lecoq. et Lamotte, Eur.

Anthriscus Cerefolium, Hoffm., Eur.
sylvestris, Hoffm., Eur.

Antirrhinum Asarina, L., Italy.
Orontium, L., Eur.
rupestre, Boiss. et Reut., Spain.

Apium graveolens, L., Eur.

Aquilegia atrata, Koch., Alps, Eur.
Bertolonii, Schott., Ital.
chrysantha, Gray, N. Amer.
— var.
cœrulea × chrysantha.
flavescens, S. Wats., Californ.
glandulosa, Fisch., Altai.
— var. parviflora, Regel.
nevadensis, B. & R., N. Grenad.
olympica, Boiss., Greece.
sibirica, Lam., Siberia.
— var. alba, Hort.
Stuartii, Hort. ×.
vulgaris, L., Eur.
— var. monstrosa.

Arabis albida, Stev., Caucas.
— var.
alpina, L., Eur., N. Afr.
muralis, Bert., var. rosea, DC., Eur.
petræa, Crantz., Eur.
pumiia, Jacq., S. Eur.
Soyeri, B. et R., Pyrenees.
stricta. Huds,. Eur.
Turczaninowii, Led., Siberia.

Archangelica officinalis, Hoffm., Eur.

Arctium majus, Schk., Eur.
— var. Kotschyi, Hort.

Arenaria hirta, Wormsk., Eur.
fasciculata, Gouan, Eur. (Alsine Jacquinii, Koch.)
graminifolia, Schrad., S. Eur.
— var. multiflora.
— var. parviflora.
gypsophiloides, Schreb., Orient.
laricifolia, L., Eur.

Argemone hispida, Hook., Calif.
mexicana, L., Mexico.
— var. alba.

Armeria maritima, Willd., Eur.
— var. alba.

Arnica montana, L., Eur.

Arrhenatherum avenaceum, Beauv., Eur.

Artemisia annua, L., S. E. Eur.
parviflora, Roxb., India.
rupestris, L., Eur. Siber.

Arum italicum, Mill., Eur.

Asparagus officinalis, L., Eur.

Asperula azurea, Jaub. et Spach., Syria.
galioides, Bbrst., Eur.
tinctoria, L., Eur.

Asphodelus albus, Willd., Eur.

Asprella hystrix, Willd. N. Amer.

Aster corymbosus, Ait., N. Amer.
Curtisii, Gray, N. Amer.
puniceus, L., N. Amer.
— var. lucidulus, Gray. (A. vimineus, T. et Gr.)
pyrenæus, DC., Pyren.
radula, Ait., N. Amer.
sibiricus, L., Siber.
tricephalus, C. B. Clarke, Himal.

Astragalus ægyptiacus, Spr., Egypt.
boeticus, L., Spain, Italy, etc.
chinensis, L., China.
chlorostachys, Ldl., Himal.
Cicer, L., Eur.
frigidus, Gray, N. Amer.
glycyphyllus, L., Eur.
scorpioides, Pourr., Spain.
sulcatus, L., Siber., Taur.

Astrantia Biebersteinii, F. et M., Caucas.
helleborifolia, Salisb., Caucas. (A. maxima, Pall.)

Astrantia—*cont.*
major, L., Eur., etc.
— var. carinthiaca, (Hoppe.)

Athamanta cretensis, L., Eur.

Atriplex Babingtonii, Woods., Eur.
hortensis, L., N. Asia.
— var. rubra, Hort.
sibirica, L., Siberia (Obione sibirica, Fisch.)

Atropa Belladonna, L., Eur.

Aubrietia deltoidea, DC., S. Eur.
— var. græca, (Griseb.)
erubescens, Griseb., Greece.
gracilis, Sprun., Eur.

Avena brevis, Rth., Eur.
distichophylla, Vill., Europe.
fatua, L., Eur.
— var. intermedia, Lindgr.
pratensis, L., Eur. Siber. (A. bromoides, L.)
pubescens, Huds., Eur.
strigosa, Schreb., Eur.

Baeria chrysostoma, F. et M., Calif.
gracilis, Gray, W. Calif.

Bahia lanata, DC., N. Amer. (Eriophyllum cæspitosum, Dougl.)

Baptisia australis, R. Br., N. Amer.

Barbarea intermedia, Bor., Eur.
praecox, Br., Eur.
vulgaris, R. Br., Eur.
— var. variegata.

Beckmannia erucæformis, Host, Eur., etc.

Beta trigyna, W. et K., E. Eur.
vulgaris, L., Eur., Afr., etc.

Bidens humilis, H. B. K., Chili.
leucantha, Willd., N. Amer., etc.

Biscutella ciliata, DC., S. Eur.
didyma, L., S. Eur.
erigerifolia, DC., Spain.

Blitum (*see* Chenopodium).

Blumenbachia insignis, Schrad., Monte Video.

Boissiera Danthoniæ, A.Br., Orient.

Bonaveria Securidaca, Rch., Eur.

Boykinia major, Gray, N. Amer.

Brachycome iberidifolia, Benth., Austral.

Brachypodium distachyum, R. et S., Medit.

Brassica balearica, P., Eur.
campestris, L., Eur., etc. (B. chinensis, L.)
Eruca, L., S. Eur.
Erucastrum, Vill., S. Eur.
juncea, Hk. f. et Th., N. Ind.
nigra, Koch, Eur.
oleracea, L., Eur.
— var. capitata.
Pollichii, Shuttl.
rugosa, Roxb., Thibet.
Tournefortii, Gouan, Spain, etc.

Briza gracilis, Hort.
media, L., Eur.
minor, L., Eur.

Brodiæa congesta, Sm., N. Amer.
peduncularis, Wats., Calif.

Bromus adœnsis, Hochst.
Biebersteinii, R. et S., Caucas.
breviaristatus, Thurb., N. Amer.
ciliatus, L., N. Amer.
erectus, Huds., Eur., etc.
madritensis, L., Eur.
maximus, Desf., Eur.
— var. Gussonii, (Parl.)
mollis, L., Eur., etc.
patulus, Mert., Eur.
propendens, Jord., Eur.
racemosus, L., Eur.
sterilis, L., Eur.
Taena, Steud., Chili.
tectorum, L., Eur., Asia.

Browallia viscosa, H.B.K., Peru.

Bryonia dioica, L., Eur.

Bulbine annua, Willd., Cape.

Bunias orientalis, L., Orient.

Buphthalmum speciosum, Schreb., Eur.

Bupleurum Candollei, Wall., Himal.
multinerve, DC., Siberia.
rotundifolium, L., Eur.

Butomus umbellatus, L., Eur.

- Calamagrostis varia, P.B., Eur.
- Calamintha grandiflora, Lam., S. Eur.
  - officinalis, Mich., var. umbrosa, Rchb., Eur.
- Calandrinia glauca, Schrad., Eur.
  - pilosiuscula, DC., Chili.
  - umbellata, DC., Chili.
- Calceolaria mexicana, Benth., Mexico.
- Calendula arvensis, L., S. Eur.
  - hybrida, L., S. Eur.
  - officinalis, L., S. Eur.
  - -- var. orange, king.
- Calliopsis (*see* Coreopsis).
- Callistephus chinensis, Nees., China.
- Calochortus splendens, Dougl., Calif.
- Caltha palustris, L., Eur., etc.
  - — var. minor, Syme.
- Camassia esculenta, Ldl., N. Amer.
  - Leichtlinii, S. Wats., Calif.
- Camelina sativa, Crantz, Eur., etc.
- Campanula alliariæfolia, Willd., Caucas.
  - carpathica, L. fil., Carpath.
  - — var. alba.
  - — var. turbinata, (Schott.)
  - collina, Bbrst., Caucas.
  - drabifolia, S. & S., Greece.
  - — var. alba.
  - Erinus, L., Eur.
  - glomerata, L., Eur., etc.
  - lactiflora, Bbrst., Caucas.
  - — var. cœrulea.
  - latifolia, L., Eur., etc.
  - — var. macrantha, (Fisch.)
  - — var. versicolor, (Sib. et Sm.)
  - latiloba, DC., Olympus.
  - medium, L., Eur.
  - persicifolia, L., Eur., etc.
  - — var. alba.
  - primulæfolia, Brot., Portugal.
  - ramosissima, S. & S., Dalm.
  - rapunculoides, L., Eur.
  - reuteriana, B. & B., Orient.
  - rhomboidalis, L., Eur.
  - Scheuchzeri, Vill., Eur.
  - sibirica, L., Eur., Asia.
  - thyrsoides, L., Eur.
  - Trachelium, L., Eur.
- Cannabis sativa, L.
- Cardamine græca, L., Greece. (Pteroneuron græcum, DC.)
  - impatiens, L., Eur.
  - ludoviciana, Hook., N. Amer.
- Carduus crispus, L., Eur.
  - orthocephalus, Wallr. × (C. nutanti × acanthoides, K.).
  - stenolepis, (K. et K.), Siber.
- Carex adusta, Boot, N. Amer.
  - Buxbaumii, Whlnb., Eur.
  - depauperata, Good., Eur.
  - divulsa, Good., Eur.
  - flava, L., Eur., etc.
  - — var. Oederi, Ehrh.
  - Heleonastes, Ehrh., Eur.
  - hirta, L., Eur.
  - hordeiformis, Whlbrg., Eur. Cauc. (C. hordeistichos, Vill.)
  - leporina, L., Eur.
  - paniculata, L., Eur.
  - pendula, Huds., Eur.
  - scirpoidea, Michx., N. Amer. (wormskioldiana, Horn.)
  - sylvatica, Huds., Eur.
  - vulpina, L., Eur.
- Carpoceras sibiricum, Boiss., Siber.
- Carrichtera Vella, DC., Eur.
- Carthamus tinctorius, L., Eur.
- Carum Carvi, L., Eur.
  - rigidulum, Koch., Italy.
- Catananche lutea, L., Italy, etc.
- Cathcartia villosa, Hk. f., Himal.
- Caucalis daucoides, L., Eur.
- Celsia orientalis, L., Orient, etc.
- Centaurea Cyanus, L., Eur.
  - — fl. pl.
  - — minor.
  - dealbata, Willd., Caucas.
  - jacea, L., Eur.
  - melitensis, L., Eur.
  - moschata, L., Greece, etc.
  - — var. flava.
  - — var. purpurea.
  - nigrescens, Willd., Eur.
  - nigra, L., Eur.
  - Scabiosa, L., Eur.
  - — var. alba.
  - — var. olivieriana, (DC.)
  - sonchifolia, L., Medit.

Cephalaria alpina, Schrad., Eur.
tatarica, Schrad., Siberia.
Cerastium frigidum.Bbrst.,Caucas.

Ceratocephalus (*see* Ranunculus).

Ceratochloa unioloides, DC., S. Eur. (Bromus unioloides, H.B.K.)

Cerinthe alpina, Kit., Eur.
aspera, Bth., Eur.
maculata, Bbrst., var. auriculata, Ten., Eur.

Chamæpeuce (*see* Cnicus).

Charieis heterophylla, Cass, Cape.
— var. rubra.

Cheiranthus Cheiri, L., Eur.

Chelidonium majus, L., Eur.
— var. fl. pl.
— var. laciniatum.

Chelone Lyoni, Pursh, N. Amer.

Chenopodium album, L., Eur.
aromaticum, Hort., Berlin.
Atriplicis, L., China.
Bonus-Henricus, L., Eur.
capitatum, S. Wats., Eur.
fœtidum, Schrad., Eur.
graveolens, Willd., Mexico.
opulifolium, Schrad., Eur.
Quinoa, L., S. Amer., etc.
virgatum, Benth. et Hook., S. Eur. (Blitum virgatum, L.)

Chionodoxa luciliæ, Boiss., Asia Minor.

Chorispora tenella, DC., Cauc., etc.

Chrysanthemum carinatum, Schousb., N. Afr.
— var. atrococcineum.
— var. golden feather.
cinerariæfolium, Vis., Dalmatia. (Pyrethrum cinerariæfolium, Trev.)
coronarium, L., S. Eur.
— var. album.
— var. fl. pl.
corymbosum, L., Eur. (Pyrethrum Clusii, Fisch.)
Leucanthemum, L., Eur.
maximum, DC., Pyrenees.
macrophyllum, W. et K., Eur. (Pyrethrum macrophyllum, Willd.)
multicaule, Desf., N. Afr.

Chrysanthemum—*cont.*
Parthenium, Pers., Eur.
segetum, L., Eur.
setabense, Duf., Eur.
Tchihatcheffii (Pyrethrum, Regel.), Siber.
viscosum, Desf., Spain.

Cicer arietinum, L., Eur.

Cichorium Intybus, L., Eur.

Cimicifuga fœtida, L., Eur.
racemosa, Nutt., N. Amer.

Cirsium (*see* Cnicus).

Clarkia elegans, Lindl., Calif.
pulchella, Pursh., N. Amer.
— var. alba.

Claytonia perfoliata, Don., N. Amer.
sibirica, L., N. Amer. (C. alsinoides, Sims.)

Clematis integrifolia, L., S. Eur.
ochroleuca, Ait., N. Amer.
recta, L., Eur., etc.

Cleome speciosa, H. B., Carthagen.
violacea, L., Eur.

Cnicus altissimus, Willd., N. Amer.
ciliatus, Willd., Eur.
fimbriatus, Bbrst., Taurus.
horridus, Bbrst., Caucas.
lanceolatus, Willd., Eur.
oleraceus, L., Eur.
serrulatus, Bbrst., Eur., Cauc.
syriacus, Willd., Medit.

Cochlearia danica, L., N. Eur.
glastifolia, L., S. Eur.
officinalis, L., Eur.

Codonopsis ovata, Benth., Himal.

Colchicum speciosum, Stev., Cauc.

Collinsia bartsiæfolia, Benth., Calif.
bicolor, Benth., Calif.
— var. multicolor.
grandiflora, Dougl., N. Amer.
parviflora, Dougl., N. Amer.

Collomia coccinea, Lehm., Chili.
gilioides Benth., Calif.
grandiflora, Dougl., Calif.
linearis, Nutt., Calif.

Conringia perfoliata, Link, Eur.

Convallaria majalis, L., Eur., Amer.
— var. major.
— var. rosea.

Convolvulus tricolor, L., Medit.
— var. alba.
— var. monstrosa.
undulatus, Cav., Medit.

Coreopsis atkinsoniana, Dougl., Oregon.
coronata, Hook., E. Texas.
Douglasii, B. et H., Calif. (Leptosyne Douglasii, DC.)
Drummondi, T. & G., Texas.
grandiflora, Nutt., N. Amer.
maritima, Hook., Calif. (Leptosyne maritima, Gray.)
lanceolata, L., N. Amer.
— var. villosa, Michx.
tinctoria, Nutt., N. Amer.
— var. astrosanguinea.
— var. bicolor.

Coriandrum sativum, L., Eur., etc.

Corispermum hyssopifolium, L., S. Eur.

Cortusa Matthioli, L., Eur.
— var. grandiflora.

Corydalis glauca, Pursh., United States.

Cosmidium burridgeanum, Hort. ×.

Cotula coronopifolia, L., Eur.

Crepis biennis, L., Eur.
grandiflora, Tausch., Eur.
hyoseridifolia, Tausch., Eur.
pulchra, L., Eur.
rubra, L., S. Eur.
setosa, Hall. f., Eur.
tectorum, L. fil., Eur., Siberia.

Crocus balansæ, Gay, As. Minor.
bannaticus, Heuffel, Transylvania.
dalmaticus, Vis., Dalmatia.
Imperati, Ten., Italy.
medius, Balbis, Riviera.
nudiflorus, Sm., Eur.
reticulatus, Bbrst., Caucas., etc.
sativus, L., Cult.
— var. cartwrightianus, Herb.
Sieberi, Gay, Greece, etc.
speciosus, Bbrst., Caucas., etc.
tommasinianus, Herb., Dalmat.
vernus, All., C. Eur.
— var. albiflorus, Gay.
versicolor, Ker., Eur.
zonatus, Gay, Cilicia.

Crucianella ægyptiaca, L., Egypt.

Cryptostemma calendulaceum, R.Br., Cape.

Cuminum Cyminum, L. Egypt.

Cuphea lanceolata, Ait., Mexico. (C. silenoides, Nees.)
viscosissima, Jacq., Amer.
Zimapani, Roezl, Mexico. (C. silenoides, var. Zimapani, Hort.)

Cynoglossum officinale, L., Eur.
pictum, Ait., Eur.

Cynosurus cristatus, L., Eur.
elegans, Desf., S. Eur.

Cysticapnos africanus, Gærtn., Cape.

Dactylis glomerata, L., Eur., etc.

Dahlia coccinea, Cav., Mexico. (D. Cervantesii, Lag.)
scapigera, L. & O., Mexico.
variabilis, Desf., Mexico.

Datura fastuosa, L., S. Amer.
— var. rubra.
lævis, L. fil., Africa.
Stramonium, L., Eur.
Tatula, L., Eur., etc.
— var. gigantea.

Daucus Carota, L., Eur., etc.
hispidus, Desf., Eur., N. Afr.

Delphinium Ajacis, Reichb., S. Eur.
— var. fl. pl.
cardiopetalum, DC., Eur.
caucasicum, L., Caucas.
Consolida, L., Eur.
crassifolium, Schrad., Cauc.
dictyocarpum, DC., Siberia.
elatum, L., Eur., etc.
— var. intermedium.
formosum, Hort.
grandiflorum, L., China, etc. (D. chinense, Fisch.)
— var.
maackianum, Regel., Asia Minor.
orientale, Gay, Eur., Orient.
Staphisagria, L., Eur.
triste, Fisch., Siberia.
trolliifolium, Gray, Amer.
vestitum, Wall., Himal.

Deschampsia cæspitosa, Beauv., Eur. (Aira cæspitosa, L.)
— var. vivipara.
flexuosa, Trin., Eur. (Aira flexuosa, L.)

Desmazeria sicula, Dmrt., Eur.

Dianthus arenarius, L., Eur.
atrorubens, All., Eur.
Caryophyllus, L., Eur.
carthusianorum, L., Eur.
— var. sabuletorum, Heuffl.
cæsius, Sm., Eur.
— var.
caucasicus, Sims., Caucas.
deltoideus, L., Eur.
fimbriatus, Bbrst., Orient.
fragrans, Bbrst., Caucas.
giganteus, D.'Urv., E. Eur.
intermedius, Boiss., var. ambiguus, Panc., Servia.
liburnicus, Bartl., Eur.
— var. vulturius, Guss.
longicaulis, Ten., Italy.
monspessulanus, L., Eur.
petræus, W. & K., E. Eur.
pelviformis, Heuffl., Transyl.
plumarius, L., Eur.
— var. serotinus.
prolifer, L., Eur.
pulchellus, Pers., Eur.
Requienii, G. et G., S. Eur.
tener, Balb., Eur.

Dictamnus albus, L., W. Eur., Jap. (D. Fraxinella, Pers.)

Digitalis lutea, L., Eur.
purpurea, L., Eur.
— var. alba, Hort.

Dimorphotheca annua, Less., Cape. (Calendula pluvialis, L.)

Dioscorea pyrenaica, Bub. et Bord., Pyren.

Diplotaxis erucoides, DC., Mediter.

Dipsacus asper, Wall., Himal.
atratus, Hkf. & Th., Himal.
sylvestris, L., Eur.

Dischisma arenarium, C. A. Mey., Cape.

Dorycnium herbaceum, Vill., Eur.

Draba aizoides, L., Eur.
borealis, DC., Isl. of St. Paul.
frigida, Saut., Alps, Eur.
incana, L., Eur.
— var. stylaris, (Gay.)
lasiocarpa, Reichb., S. Eur.

Dracocephalum Moldavica, L., Siber., etc.
nutans, L., Siberia.
parviflorum, Nutt., N. Amer.
peregrinum, L., Siberia.

Drusa oppositifolia, DC., Teneriffe.

Dryas octopetala, L., Eur., Amer.

Echinops globifer, Janka, Transyl.
sphærocephalus, L., Eur.

Elsholtzia cristata, Willd., S. Eur.

Elymus canadensis, L., N. Amer.
— var. glaucifolius, Gray.
sibiricus, L., Siber.
virginicus, L., N. Amer.

Emex spinosa, Camb., S. Eur.

Encelia subaristata, Gray, N. Amer.

Epilobium alpestre, Jacq., Eur.
alsinefolium, Vill., Eur.
angustifolium, L., Eur.
— var. album.
— var. major.
Fleischeri, Hochst., Eur.
hirsutum, L., Eur.
Lamyi, Schultz, S. Eur.
nummulariæfolium, A. Cunn., N. Zeal.
— var. pedunculare, Cunn.
parviflorum, Retz., Eur.
roseum, Retz., Eur.
rosmarinifolium, Hænke, Eur.
— var. sericeum.
tetragonum, L, Eur.

Eranthis hyemalis, Salisb., Eur.

Eremostachys laciniata, Bnge, W. Asia.

Eremurus Kaufmanni, Rgl., Turkestan.

Erigeron aurantiacus, Regel., Turkestan.
glabellus, Nutt., N. Amer.
— var. asperus, Gray.
pulchellus, Regel., Turkestan.
strigosus, Muhl., N. Amer.

Erinus alpinus, L., Eur.
— albus.

Eritrichium strictum, Dcne., Himal.

Erodium gruinum, Willd., Sicily.
macradenum, L'Herit., Alps.
malacoides, Willd., Eur.
moschatum, L'Her., Eur.
serotinum, Stev., Orient.

Ervum Lens, L., Eur., etc.

Eryngium giganteum, Bbrst., Caucas.
macrocalyx, Schr., Songaria.

Erysimum aureum, Bbrst., Eur., Orient.
marshallianum, Andrz., Siber.
ochroleucum, DC., var. helveticum, DC., Eur.
Wahlenbergii, Simonk, Transs.

Eschscholtzia californica, Cham., Calif.
— var. alba.
— var. aurantiaca.
— cæspitosa, Brewer. (E. tenuifolia, Bth.)

Eucharidium concinnum, F. et M., Calif.
— var. grandiflorum.

Eupatorium ageratoides, L., N. Amer. (E. Fraseri, Hort.)

Euphorbia Bornmülleri, Haussk., Asia Minor.
exigua, L., Eur.
flavicoma, DC., Eur.
hierosolymitana, Boiss., Syria.
Myrsinites, L., Eur.
Preslii, Guss., Eur.
segetalis, L., Eur.

Fedia Cornucopiæ, G., Eur.

Ferula communis, L., Eur.
Linkii, Web., Ins. Canaries.

Festuca ampla, Hack., Eur.
asper, Murr., Eur.
delicatula, Lag., Eur.
duriuscula, L., Eur., Amer.
— sub-var. crassifolia.
elatior, L., Eur., etc.
— var. pratensis, (Huds.)
gigantea, Vill., Eur.
Halleri, All., S. Eur.
heterophylla, Lam., Eur.
Myurus, L., Eur. (Vulpia Myurus, Gmel.)
ovina, L., Eur.
panciciana, Hack.
rigida, Kunth, Eur. (Sclerochloa rigida, Panzer.)
sciuroides, Roth, Eur. (Vulpia bromoides, Link, F. bromoides, L.)
scoparia, Kern., Pyren.

Fritillaria delphinensis, Gren., Eur.
— var. Moggridgei, (Boiss. et Reut.).
Meleagris, L., Eur.
— var. alba.
ruthenica, Wikstr., Orient.

Fumaria densiflora, DC., Eur.
major, Bad., Eur. (F. media, DC.)

Funkia lancifolia, Spr., Japan.
— var. albo-marginata, Hort.
ovata, Spr., Japan.
sieboldiana, Hook., Japan.

Gaillardia pulchella, Foug., N. Amer.
— var. grandiflora.
— var. lorenziana.
— var. picta, Gray.

Galatella (*see* Aster).

Galax aphylla, L., N. Amer.

Galega officinalis, L., Eur.
orientalis, Lam., Orient.
— var.

Galeopsis pyrenaica, Bartl., Pyren.

Galinsoga brachystephana, Regel., S. Amer.
parviflora, Cav., Amer.

Galium boreale, L., Eur.
parisiense, L., Eur.
recurvum, Req., Greece.
saccharatum, All., Eur.
tenuissimum, Bbrst., Cauc.
tricorne, With., Eur.
uliginosum, L., Eur.
verum, L., Eur.

Gaura parviflora, Dougl., N. Amer.

Gentiana acaulis, L., Eur.
asclepiadea, L., S. Eur.
— var. alba.
cruciata, L., Eur. Siber.
lutea, L., Eur.
Pneumonanthe, L., Eur.
septemfida, Pall., Caucas. (G. gelida, Hort.)
tibetica, King, Himal. (G. macrophylla, Hort.)

Geranium albanum, M. B., Tauria.
armenum, Boiss., Orient.
collinum, Steph., Russia.
columbinum, L., Eur.

Geranium—*cont.*
dissectum, L., Eur.
gymnocaulon, DC., Caucas.
lucidum, L., Eur.
molle, L., Eur.
pusillum, L., Eur.
sylvaticum, L., Eur.

Gerbera Anandria, Schultz., China, Japan.

Geum chilœnse, Balb., Chili.
— var. grandiflorum, Ldl.
— var. miniatum, Hort.
macrophyllum, Willd., Siber.
molle, Vis., Servia.
montanum, L., Alps, Eur.
pyrenaicum, Ram., Pyrenees.
rivale, L., Eur.
triflorum, Pursh., N. Amer.
(Sieversia triflora, Spr.)
urbanum, L., Eur., etc.

Gilia achilleæfolia, Bth., Calif.
androsacea, Steud., Calif.
(Leptosiphon androsaceus, Bth.)
— var. rosea.
capitata, Dougl., Calif.
inconspicua, Dougl., Calif.
laciniata, R. et P., Chili, Peru.
micrantha, Steud., Calif.
(L. luteus, Benth.)
squarrosa, Hook. et Arn., Amer.
tricolor, Benth., Calif.
— var. alba.

Glaucium corniculatum, Curt., S. Eur.
— var. rubrum, Hort.

Glyceria maritima, Wahl., Eur.
remota, Fr., Eur.
(G. norvegica, Smf.)

Gnaphalium indicum, L., India.
involucratum, Forst., N. Zeal.
uliginosum, L., var. nudum, Hoffm., Eur.

Godetia (*see* Œnothera).

Gunnera scabra, R. et P., Peru, etc.

Gypsophila paniculata, L., Siberia.
rigida, L., Eur.

Hablitzia tamnoides, Bbrst., Caucas.

Hastingia alba, S. Wats., N. Amer.

Hebenstreitia tenuifolia, Schrad., Cape.

Hedypnois (*see* Rhagadiolus).

Hedysarum boreale, Nutt., N. Amer.
microcalyx, Baker, Himal.
neglectum, Ledeb., Attai.
obscurum, L., Eur.

Helenium setigerum, B. et H., California.

Helianthemum polifolium, Mill., Eur.
salicifolium, P., Eur.
vulgare, Gærtn., Eur.
— var.

Helianthus annuus, L., N. Amer.
debilis, Nutt., var. cucumerifolius, Gray, Texas.

Helichrysum bracteatum, Willd., Austral.
— var. album.
— var. luteum.

Heliophila amplexicaulis, L. fil., Cape.
araboides, Sims, Cape.
(H. pilosa, Lam.)
crithmifolia, Willd., Cape.

Helipterum Manglesii, Bth., Austral.
(Rhodanthe Manglesii, Ldl.)
Milleri, Hort., Australia.
roseum, Benth., Australia.
(Acroclinium roseum, Hk.)

Helleborus colchicus, Regel., Hort. ×.
fœtidus, L., Eur.
orientalis, Lam., Greece.
— var. roseus.

Helminthia echioides, G., Eur.

Helonias bullata, L., N. Amer.
— var. latifolia.

Hemerocallis flava, L., S. Eur.
fulva, L., S. Eur., etc.
— var. Kwanso, Regel.

Heracleum Panaces, L., S. Eur.
pubescens, Bbrst., var. gummiferum, Willd., Eur.
villosum, Fisch., Russia.

Heuchera Drummondi, Hort.
pilosissima, F. et M., N. Amer.
sanguinea, Eng., N. Amer.

Hibiscus Trionum, L., Cosmopol.
(H. africanum, Hort.)

Hieracium aurantiacum, L., Eur.
integrifolium, Lge., Eur.
longifolium, Schleich., Eur.
maculatum, Sm., Eur.
pallidum, Biv., Eur.
pratense, Tausch., Eur.
saxatile, Jacq., S. Eur.
stoloniflorum, W. et K., S. Eur.
villosum, L., Eur.
virgatum, Pursh., N. Amer.

Holcus lanatus, L., Eur.

Hordeum murinum, L., Eur.
pratense, Huds., Eur.
secalinum, Schreb., Eur.

Horminum pyrenaicum, L., Pyren.

Hoteia (*see* Astilbe).

Hyacinthus amethystinus, L., Spain.
romanus, L., S. Eur., etc.
(Bellevalia romana, Reichb.)

Hydrophyllum virginicum, L., N. Amer.

Hymenophysa pubescens, Meyer., Siber.

Hyoscyamus niger, L., Eur.
— var. albus, Hort.
orientalis, Bbrst., Cauc.

Hypecoum procumbens, L., S. Eur.

Hypericum perfoliatum, L., Eur.
Richeri, Vill., Eur.
— var. Burseri, Sp., Transs.

Hypochæris arachnoidea, Poir., N. Afr.

Iberis amara, L., Eur.
— var. spiralis.
ciliata, All., Alp. Marit.
garrexiana, All., Pyrenees.
lagascana, DC., Spain.
pectinata, Boiss., Spain.
umbellata, L., S. Eur.
— var. carnea.

Impatiens parviflora, DC., Siberia, etc.
Roylei, Walp., Himal.
tricornis, Wall., Himal.

Inula ensifolia, L., Eur.
grandiflora, Willd., Caucas., etc.
Helenium, L., Eur.

Iris aurea, Ldl., Himal.
fulva, Muhl., N. Amer.
Pseudacorus, L., Eur., etc.
— var. acoroides, Spach.
setosa, Pallas, Siberia.
— var. atropurpurea.
sibirica, L., Eur., Siberia.
spuria, L., Eur.
— var. notha, Bbrst.
versicolor, L., N. Amer.

Isatis tinctoria, L., Eur., etc.

Juncus balticus, Willd., Eur.
compressus, Jacq., Eur.
effusus, L., Eur.
lamprocarpus, Ehrh., Eur.
platycaulis, H.B.K., S. Amer.

Knautia (*see* Scabiosa).

Kochia scoparia, Schrad., Eur.

Kœleria Berythea, B. et B., Syria.
cristata, Pers., Eur.
phleoides, P., Eur.

Kœlpinia (*see* Rhagadiolus).

Lactuca flavida, Jord., S. Eur.
Plumieri, Gren. et Godr., S. Eur.
Scariola, L., Eur.
undulata, Ledeb., Siberia.
virosa, L., Eur.

Lallemantia peltata, Fisch. et Mey., Caucas.

Lasthenia obtusifolia, Cass., Chili.

Lathyrus angulatus, L., S. Eur.
Aphaca, L., Eur.
articulatus, L., Eur.
aureus, Benth. et Hook., Taur.
(Orobus aureus, Stev.)
Clymenum, L., S. Eur.
(O. Jordani, Tenore.)
filiformis, Lam., S. Eur.
hirsutus, L., Eur.
latifolius, L., Eur.
— var. ensifolius, Bad.
luteus, B. et Hk. f., Eur., etc.
(Orobus luteus, L.)
macrorrhizus, Wimm., Eur.
niger, Wimm., Eur.
(O. niger, L.)
Ochrus, L., Eur.
pannonicus, Gcke., var. varius, Sol., Eur.
pisiformis, L., Siberia, etc.

Lathyrus—*cont.*
  rotundifolius, Willd., Caucas.
  sphæricus, Retz., Eur.
  sylvestris, L., Eur.
  — var. Wagneri.
  tingitanus, L., N. Afr.
  tuberosus, L., Eur.
  venosus, Muhl., N. Amer.

Lavatera trimestris, L., Medit.
  — var. alba.

Layia Calliglossa, Gray., Calif.
  elegans, T. et G., Calif.
  glandulosa, Hk. et Arn., Calif., etc.

Leontodon (Hemilepis) Ehrenbergii.

Leontodon (Kalbfussia) Mülleri, (Sz.), Eur.

Leonurus tataricus, L., Asia.

Lepidium calycotrichum, Kze., Eur.
  Draba, L., Eur.
  Menziesii, DC., N. Amer.
  sativum, L., Eur.

Leptochloa fascicularis, Gr., N. Amer.

Leptosiphon (*see* Gilia).

Leptosyne (*see* Coreopsis).

Lepturus cylindricus, Trin., Eur.

Libanotis montana, Crantz, Eur.
  sibirica, Koch., Eur., etc.

Ligularia (*see* Senecio).

Ligusticum pyrenæum, Gouan., Pyren.
  scoticum, L., Eur. (Haloscias scoticus.)
  Seguieri, Koch., S. Eur.

Limnanthes Douglasii, R. Br., Amer.
  — var. grandiflora.

Linaria anticaria, Boiss., Spain.
  bipartita, Willd., N. Afr.
  chalepensis, Mill., Eur.
  Broussonetii, Poir., Orient.
  dalmatica, Mill., Dalm.
  genistæfolia, Mill., Eur.
  — var. linifolia, Grab.
  minor, Desf., Eur., N. Afr.
  minutiflora, Mey., Caucas.
  Perezii, Gay., Eur.
  prætermissa, Delas., France.
  reticulata, Desf., N. Afr.

Linaria—*cont.*
  reticulata, var. purpurea.
  saxatilis, Hoffm., Eur.
  spartea, Hoffm., S. Eur.
  triphylla, Willd., S. Eur.
  tristis, Mill., S. Eur.
  vulgaris, Mill., Eur.

Lindelophia spectabilis, Lehm., Himal.

Linum alpinum, L., Eur. (L. Leonii, Schultz.)
  angustifolium, L., Eur.
  grandiflorum, Desf., N. Afr.
  — var. coccineum.
  perenne, L., Eur., etc.
  — Lewisii, (Mhlbrg.)
  usitatissimum, L., Eur.

Lithospermum latifolium, Michx., N. Amer.

Loasa volcanica, Andr., New Gren. (L. Wallisii, Hort.)

Lobelia Erinus, L., Cape.
  triquetra, L., Cape.

Lolium perenne, L., Eur.

Lonas inodora, Gærtn., Sicily. (Athanasia annua, L.)

Lopezia coronata, Andr., Mexico. (L. minuta, Hort.)

Lophanthus rugosus, F. et M., China.

Lotus major, Scop., Eur.
  ornithopodioides, L., Eur.
  tenuis, W. et K., Eur., etc.

Lunaria annua, L., Eur.
  rediviva, L., S. Eur.

Lupinus angustifolius, L., S. Eur.
  — var. macrocarpus, Hort.
  Cosentini, Guss., Greece, etc.
  Cruikshanksii, Hook., Peru.
  elegans, H. B. K., Mexico.
  hilariensis, Benth., Brazil.
  luteus, L., France, etc.
  micranthus, Dougl., N. Amer.
  mutabilis, Sweet., Bogot.
  polyphyllus, Ldl., N. Amer.
  — var.
  pulchellus, Sweet., Mexico.
  pubescens, Benth., N. Amer.
  recurvatus, Meyer., Chili.
  tricolor, Hort.
  varius, L., Eur.

Luzula angustifolia, Poir., Carolina.
campestris, DC., Eur.
nivea, Desv., Eur.

Lychnis alba, Mill., Eur.
chalcedonica, L., E. Eur., etc.
Flos-jovis, Desv., S. Eur.
Githago, Lam., Eur. (Agrostemma Githago, L.)
hybrida splendens, Hort. ×.
lagascæ, Nym., Eur.
læta, Ait., S. Eur., etc.
oculata, Ldl., Levant.
— var. elegans.
Viscaria, L., Eur.

Lysimachia acroadenia, Max., Japan.
ciliata, L., N. Amer.
davurica, Willd., Davuria.
Leschenaultii, Dub., Himal.
punctata, L., Eur.

Lythrum Salicaria, L., Eur.
— var. roseum.

Madia elegans, Don., N. Amer.
sativa, Molin., Oregon, Calif.
— var. racemosa, Gray.

Malcolmia africana, R.Br., S. Eur., N. Afr.
chia, DC., Greece.
littorea, R.Br., S. Eur.
maritima, R.Br., S. Eur., etc.

Malope trifida, Cav., N. Afr.
— var. alba.

Malva crispa, L.
Duriæi, Spach., N. Afr.
moschata, L., Eur.
— var. alba.
oxyloba, Boiss., Oriens.
parviflora, L., Eur.
sylvestris, L., Eur., etc.
— var. alba.

Malvastrum limense (L.), Chili.

Mandragora vernalis, Bert., Orient.

Marrubium astracanicum, Jacq., Caucas.
vulgare, L., Eur.

Matricaria caucasica, Benth., Caucas, (Pyrethrum caucasicum, Willd.)
inodora, L., Eur.
— var. discoidea (DC.).

Matthiola bicornis, DC., Eur.

Meconopsis cambrica, Vig., Eur.
nepalensis, DC., Nepal.
wallichiana, Hook., Himal.

Medicago apiculata, W., Eur.
(berteroana, Mor.)
Echinus, DC., S. Eur.
lappacea, Desr., S. Eur.
littoralis, Rhod., Eur.
lupulina, L., Eur.
marina, L., Eur.
murex, Willd., Eur.
muricata, All., Eur.
orbicularis, Willd., S. Eur.
sativa, L., Eur.
tuberculata, W., Eur.

Melica ciliata, L., Eur., etc.
— var. penicillaris, (Boiss.)
glauca, F. Sz., var. nebrodensis, Parl., Eur.
nutans, L., Eur.

Melilotus alba, Desr., Eur.
officinalis, Desr., Eur.
parviflora, Lam., Eur.
(M. indica, All.)

Mentzelia Lindleyi, T. et G., Calif.

Mercurialis annua, L., Eur.

Mesembryanthemum tricolor, Willd., Cape.
— var. album.

Mimulus cardinalis, Dougl., N. Amer.
cupreus, Veitch., Chili.
glabratus, H. B., Mexico.
luteus, L., N. Amer.
moschatus, Dougl., N. Amer.

Modiola multifida, Mœnch, N. Amer.

Molinia cærulea, Mœnch, Eur.
— var. variegata.

Monolepis chenopodioides, Moq., N. Amer.

Moricandia arvensis, DC., Eur.

Morina longifolia, Wall., Nepal.

Mulgedium (*see* Lactuca).

Muscari Argaei, Hort.
armeniacum, Baker, Medit.
atlanticum, Boiss., Spain, Algeria.
Heldreichii, Boiss., Greece.
neglectum, Guss., S. Eur.
racemosum, Mill., Eur.
szovitsianum, Regel, Siber.

Myosotis arvensis, Hoffm., Eur.
  cæspitosa, K. F. Sch., Eur.
  collina, Hoffm., Eur.
  sylvatica, Hoffm., Eur.

Myosurus minimus, L., Eur., etc.

Myrrhis odorata, Scop., Eur.

Nardurus tenellus, Rchb., Spain.

Nardus stricta, L., Eur.

Nemesia floribunda, Lehm., Cape.
  pubescens, Benth., Cape.
  versicolor, Mey., Cape.

Nemophila aurita, Lindl., Calif.
  insignis, Dougl., Calif.
  — var. alba, Hort.
  — var. grandiflora, Hort.
  maculata, Bth., Calif.
  Menziesii, Hook. et Arn., Calif.
  parviflora, Dougl., N. Amer.

Neogaya mucronata, Regel., Siber.

Nepeta nepetella, L., Eur.
  nuda, L., Eur.

Nicandra physaloides, Gærtn., Peru.

Nicotiana Langsdorffii, Weinm., Brazil.
  paniculata, L., S. Amer.
  rustica, L., S. Eur., etc.
  Tabacum, L., S. Amer.
  trigonophylla, Dun., Mexico.

Nigella damascena, L., S. Eur.
  — var.

Nycterinia capensis, Benth., S. Afr.

Œnanthe crocata, L., Eur.
  globulosa, L., S. Eur.
  gymnorrhiza, Brign., C. et S., Eur.
  karsthia, Hacq., Carniol.
  peucedanifolia, Poll., Eur.
  silaifolia, Bbrst., Eur., etc.

Œnothera amœna, Lehm., Calif.
  (Godetia amœna, Lilja.)
  — var. rubicunda, Hort.
  biennis, L., N. Amer.
  — var. grandiflora, T. et G.
  densiflora, Lindl., Calif.
  dentata, Cav., N. Amer.
  fruticosa, L., N. Amer.
  — var. Youngii, Hort.
  glauca, Michx., N. Amer.

Œnothera—*cont.*
  odorata, Jacq., Patagonia.
  pumila, L., N. Amer.
  rosea, Ait., N. Amer.
  tenella, Cav., Chili, Amer.
  (G. tenella, Wats.)
  triloba, Nutt., N. Amer.

Omphalodes linifolia, Mœnch, Eur.

Ononis arvensis, Mur., Eur.
  Natrix, L., S. Eur.
  rotundifolia, L., Eur.
  spinosa, L., Eur., etc.
  — var. alba.
  repens, L., Eur.
  (procurrens, Wallr.)

Onopordon Acanthium, L., Eur.
  tauricum, Willd., Eur.

Orchis foliosa, Sol., Madeira.
  incarnata, L., Eur.
  latifolia, L., Eur.
  maculata, L., Eur.
  — var. superba.

Ormenis (*see* Anthemis).

Ornithogalum latifolium, L., Egypt, etc.
  narbonense, L., Eur.
  orthophyllum, Ten., Italy.
  tenuifolium, Guss., Eur.
  umbellatum, L., Eur., etc.
  — var. Leichtlinii.

Orobanche minor, Sm., Eur.

Orobus (*see* Lathyrus).

Oxyria elatior, R. Br., Nepal.

Oxytropis campestris, DC., Eur.
  ochroleuca, Bunge, Siber.

Pachypodium erysimoides, Web., N. Amer.

Pæonia arietina, Anders., Orient.
  — var. Andersoni.
  decora, Anders., Orient.
  — var. Pallasii, Hort.
  peregrina, Mill., Orient.

Palava flexuosa, Mast., Peru.

Panicum Crus-galli, L., S. Eur.

Papaver apulum, Ten., Eur.
  Argemone, L., Eur.
  caucasicum, Bbrst., Caucas.
  dubium, L., Eur.

Papaver—*cont.*
dubium, var. Lecoqii (Lamotte), Eur.
glaucum, Boiss., Orient.
nudicaule, L., Alps.
— var. album.
orientale, L., Orient.
— var. bracteatum, (Lindl.)
— var. majus.
pavoninum, C. A. Mey., Afghan.
pilosum, Sibth., Greece.
— var.
Rhœas, L., Eur.
— var. Hookeri, (Baker).
— var. "Shirley."
rupifragum, Boiss., Spain.
— var. atlanticum, Ball, G. Atlas.
somniferum, L., China, etc.
— var. "Danebrog."
— var. fl. pl.

Parietaria lusitanica, L., Eur.
officinalis, L., Eur.

Parnassia palustris, L., Eur.

Pastinaca (*see* Peucedanum).

Pentstemon barbatus, Nutt., N. Amer.
— var. Torreyi, Gray.
cæruleus, Gray., N. Amer.
confertus, Dougl., N. Amer.
diffusus, Dougl., N. Amer.
glaber, Pursh., N. Amer.
Hartwegii, Benth., Mexico.
ovatus, Dougl., N. Amer.
pubescens, Sol., N. Amer.

Perezia multiflora, Less., Peru, etc.

Petroselinum sativum, Hoffm., Eur.

Petunia nyctaginiflora, Juss., La Plata.

Peucedanum Ostruthium, K., Eur.
sativum, Benth., Eur. (Pastinaca sativa, L.)

Phaca oroboides, DC., Eur.

Phacelia campanularia, Gray., Calif.
divaricata, Gray., Calif.
Parryi, Torr., Calif.
tanacetifolia, Bth., Calif.
viscida, Torr., Calif.

Phacelia—*cont.*
Whitlavia, Gray, Calif. (Whitlavia grandiflora, Hort.)
— var. alba, Hort.

Phalaris paradoxa, L., S. Eur.
tuberosa, L., Eur.

Phaseolus multiflorus, Lam.
ricciardianus, Ten.
tuberosus, Lour., Cochinchina.
vulgaris, L., India.
willmotianus, Mart.
wightianus, Grah., India.

Phleum asperum, Jacq., Eur.
Bœhmeri, Wib., Eur.
pratense, L., Eur.
— var. nodosum, (L.)

Phlomis russeliana, Lagas., Orient.
umbrosa, Turcz., Siberia.

Phlox Drummondi, Hook., Calif.
— var. cuspidata.

Physalis Alkekengii, L., Eur.

Phyteuma Halleri, All., S. Eur.
limonifolium, Sibth. et Sm., Eur.
Michelii, All., Eur.
nigrum, Schmidt, Germ.
orbiculare, L., Eur.

Phytolacca acinosa, Roxb., India.

Picridium tingitanum, Dsf., Eur.

Picris hieracioides, L., Eur.

Pisum sativum, L., Eur.

Plantago arenaria, L., Eur.
Coronopus, L., Eur.
— var. Cupani, Guss.
Cynops, L., Eur.
Ispaghula, Roxb., India.
lanceolata, L., Eur.
maritima, S., Eur.

Platycodon grandiflorum, A.DC., Siber.
— var. Mariesii, Hort.

Platystemon californicus, Benth., Calif.

Pleurospermum pulchrum, Aitch. et Hemsl., Afghan.

Poa alpina, L., Eur.
— var. badensis, Hke.
chinensis, L., China, etc.
compressa, L., Eur.
glauca, Sm., Eur.
nemoralis, L., Eur.
palustris, L., Eur.
pratensis, L., Eur.
sudetica, Haenke, Eur.
trivialis, L., Eur.
violacea, Bell., Eur.

Podophyllum Emodi, Wall., Himal.

Polemonium cæruleum, L., Eur., Amer., etc.
— var. album, Hort.
flavum, Greene, Amer.
himalayanum, Baker, Himal.
pauciflorum, Wats., Mexico.
reptans, L., N. Amer.
Richardsoni, Grah., N. Amer.

Pollinia Gryllus, Spr., Eur.

Polygonatum multiflorum, All., Eur.
verticillatum, All., Eur.

Polygonum aviculare, L., Eur. (P. erectum, Rth.)
Bistorta, L., Eur.
capitatum, Don., Himalayas.
molle, Don., Himal.
viviparum, L., Eur.
Weyrichii, F. Schm., Sachal. Isl.

Portulacca oleracea, L., China, etc.
— var. grandiflora.

Potentilla argyrophylla, Wall., Himal.
— var.
crocea, Hall f., Eur.
Detommasii, Ten., Eur.
dichtliana, Hort.
digitata × flabellata.
glandulosa, Ldl., Calif.
kotschyana, Fenzl., Kurdistan.
kurdica, Boiss., Orient.
leschenaultiana, Ser., Ind., Or.
malacophylla, Bunge., Orient.
nevadensis, Boiss., Spain.
pedata, Willd., France.
pennsylvanica, L., N. Amer.
— var. arachnoidea, Lehm. (P. arachnoidea, Dougl.)

Potentilla—*cont.*
pseudo-chrysantha.
pyrenaica, Ram., Pyren.
recta, L., Eur., Caucas.
— var. laciniata.
— var. macrantha, (Leab.)
— var. palmata.
rupestris, L., Eur.
schrenkiana, Regel.
semi-argentea, Hort. ×.
semi-laciniata, Hort. ×.
Sibbaldia, Haller fil., Himal. (Sibbaldia procumbens, L.)
Thurberi, Gray, N. Amer.
wrangeliana, Fisch., Siberia.

Poterium Sanguisorba, L., Eur.

Primula clusiana, Tsch., Eur.
denticulata, Sm., Himal.
japonica, Gray, Japan.
mollis, Nutt., Bootan.
obconica, Hance., China.
rosea, Royle, Himal.
verticillata, Forsk., Arabia.

Prunella vulgaris, L., Eur.

Pteroneuron = Cardamine.

Pyrethrum (*see* Chrysanthemum).

Pyrrhopappus carolinianus, DC., Florida, Texas.

Ramondia pyrenaica, Rich., Pyrenees.

Ranunculus aconitifolius, L., Eur.
Broteri, Freyn., Spain.
acris, L., Eur.
arvensis, L., Eur.
brutius, Tenore, Italy.
cassius, Boiss., Taurus.
chærophyllus, L., Eur., etc.
chius, DC., Greece, etc.
Cymbalaria, Pursh, N. Amer.
falcatus, L., Eur.
muricatus, L., Eur.
parviflorus, L., Eur.
repens, L., Eur.
trachycarpus, F. et M., Orient.

Raphanus sativus, L., Eur.

Rapistrum linnæanum, All., Eur.

Reseda abyssinica, Fres., Abyss.
alba, L., S. Eur.
glauca, L., Pyren.
lutea L., Eur.
Luteola, L., Eur.

Rhagadiolus stellatus, Gærtn., S. Eur.

Rheum collinianum, Baill.
Emodi, Wall., Himal.
macropterum, Mart.
officinale, Baill., Thibet.
palmatum, L., Ind., etc.
— var. tanghuticum.
Rhaponticum, L., Siber.
rugosum, Desf., Ind. Or.
Tranzenbachii, Hort., Berlin.
undulatum, L., Siberia, etc.
webbianum, Royle., India.

Rhodanthe (*see* Helipterum).

Richardsonia scabra, D., Amer., etc.

Rudbeckia amplexicaule, Vahl., N. Amer.
bicolor, Nutt., N. Amer.

Rumex alpinus, L., Eur.
Brownii, Campd., Austral.
nepalensis, Spr., Himal.
obtusifolius, L., Eur.
— var. sylvestris, (Wallr.)
Patientia, L., S. Eur.
pulcher, L., Eur.
purpureus, Poir., Eur.
salicifolius, Weinm., N. Amer.
vesicarius, L., N. Afr.

Sagina glabra, Willd., S. Eur.
— var. piliferia.
Linnæi, Presl., Eur.

Salpiglossis grandiflora, Hort.

Salvia æthiopis, L., S. Eur.
argentea, L., Medit.
clandestina, L., Eur.
glutinosa, L., Eur.
Horminum, L., Eur.
— var. bracteis violaceis.
interrupta, Schousb., Marocco.
nutans, L., Transyl.
officinalis, L., S. Eur.
— var. alba.
pratensis, L., Eur.
— var. alba.
— var. Baumgarteni, Grsb., Transs.
— var. rosea.
tiliæfolia, Vahl, Mexico.
Verbenaca, L., Eur.

Sanguisorba (*see* Poterium).

Saponaria calabrica, Guss., Eur.
orientalis, L., Orient.

Satureja hortensis, L., Taur., Caucas.

Saxifraga altissima, Kerner, Eur.
aphylla, Sternb., Eur.
— var. leptophylla.
Aizoon, L., Eur., Alps.
— var. Gaudinii.
— var. incrustata.
— var. infracta.
— var. La Gaveana.
— var. minor.
— var. pectinata, Schott.
— var. pygmæa.
— var. recta, (Lap.)
— var. rotata.
— var. rosularis, Schleich.
cæspitosa, L., Eur., etc.
— var. hirta, (Don.)
— var. sedoides, (L.)
Cotyledon, L., Eur., Alps.
— var. pyramidalis, (Lap.)
crustata, Vest., Alps.
Hostii, Tausch, Alps.
— var. macnabiana, Hort.
— var. tristis.
kolenatiana, Regel, Siberia.
lactea, Turcz., Temp. Asia.
lingulata, Bell., Marit. Alps.
— var. cochlearis, (Rchb.)
— var. lantoscana, (Boiss.)
longifolia, Lap., Pyrenees.
muscoides, Wulf., Eur.
— var. pygmæa, (Haw.)
Prostii, Sternb., Eur.
rocheliana, Sternb., Bosnia.
— var. coriophylla, (Griseb.)
rotundifolia, L., Eur.
— var. hirsuta.
tenella, Wulf., Alps.
trifurcata, Schrad., N. Spain.
valdensis, DC., Savoy, Alps.

Scabiosa arvensis, L., Eur.
caucasica, Bbrst., Cauc.
— var. amœna, (Jacq.)
Columbaria, L., Eur.
graminifolia, L., Eur.
gramontia, L., Eur.
micrantha, Dsf., Maced.
palæstina, L., Syria, etc.
portæ, Huter., Eur.
stellata, L., Eur.
vestina, Facch., Eur.

Scandix balansæ, Reut., Orient.
brachycarpa, Guss., Sicily.
macroryncha, C. A. Mey., Eur.
Pecten-Veneris, L., Eur.

Schizanthus pinnatus, R. et P., Chili.

Schizopetalum Walkeri, Sims, Chili.

Scilla campanulata, Ait., Spain, etc.
(S. hispanica, Mill.)
— var. alba, Hort.
— var. rubra.
chinensis, Benth., China.
lingulata, Poir., Eur.
nonscripta, Hoffm., Eur.

Scirpus setaceus, L., Eur.

Schismus marginatus, Beauv., S. Eur.

Scleranthus perennis, L., Eur.

Scorpiurus vermiculata, L., Eur.

Scrophularia aquatica, L., Eur.
Ehrhartii, Stev., Caucas.
nodosa, L., Eur.

Scutellaria altissima, L., Caucas.

Secale Cereale, L., Asia Minor.
— var. villosum.

Sedum Aizoon, L., Siberia.
Ewersii, Ledeb., Siber.
kamtschaticum, Fisch., Kamtsch.
middendorfianum, Max., Siberia.
Rhodiola, DC., Siber.
(Rhodiola sibirica, Sweet.)
stellatum, L., Eur.

Selinum Candollei, DC., Nepal.

Sempervivum boutignyanum, Bill., Pyrenees.
mettenianum, Lehm., Switz.
montanum, L., Alps.

Senecio artemisiæfolius, Pers., S. Eur.
Clusii, Schultz., Eur.
elegans, L., Cape.
— var. alba.
— var. purpurea.
macrophyllus, Bbrst., Caucas.
thyrsoideus, DC., Siberia.
(Ligularia thyrsoidea, DC.)
viscosus, L., Eur.

Serratula coronata, L., Siberia.
— var. macrophylla.
Gmelinii, Ledeb., Caucas.
quinquefolia, Bbrst., Caucas.

Seseli gummiferum, Sm., Greece.

Setaria glauca, Beauv., Eur.
italica, Beauv., Eur.
(S. germanica, Beauv.)
macrochæta, Link, Eur., Asia, etc.
viridis, Beauv.

Sherardia arvensis, L., Eur.

Sibbaldia (*see* Potentilla).

Sicyos Baderoa, Hk. et Arn., Chili.

Sidalcea candida, Gray., N. Amer.

Silene alpestris, Jacq., Alps.
Armeria, L., Eur.
— var. compacta, (Hornem.)
chloræfolia, Sm., var. swertifolia, Armenia.
Chouleti, Coss., Eur.
ciliata, Pourr., Crete.
clandestina, Jacq., Cape.
colorata, Poir., Mediter.
conoidea, L., Levant, etc.
cretica, L., Eur.
Cucubalus, Wibel., Eur.
diurniflora, Kunze, Cape.
echinata, Otth., Italy.
fimbriata, Sims., Crete, etc.
Fortunei, Vis., China.
fusca, Link, Portugal.
gallica, L., Eur.
— var.
glauca, Pourr., Eur.
gracilis, DC.
italica, Pers., Eur.
juvenalis, Del., Egypt.
linicola, Gmel., Germany.
longicilia, Otth., Portugal.
nutans, L., Eur.
obtusifolia, Willd., Italy.
paradoxa, L., S. Eur.
pendula, L., Sicily, etc.
Persoonii, Tod. non Schott.
pseudo-atocion, Desf., N. Afr.
rubella, L., Eur., N. Afr.
Sartori, Boiss., Greece.
Saxifraga, L., Eur.
sedoides, Jacq., Crete.
tatarica, Pers., Tatar.
tenuifolia, Otth., Dahur.
vesiculifera, Gay, S. Eur.

Silene—*cont.*
vespertina, Retz., S. Eur.
Zawadskii, Herbich., Austria.

Silphium scaberrimum, Ell., N. Amer.
trifoliatum, L., N. Amer.

Silybum eburneum, Coss. et Dur., Eur.
marianum, Gærtn., Eur.

Sisymbrium assoanum, Losc., Eur.
myriophyllum, H. B. K., Quito.
officinale, Scop., S. Eur.
polyceratium, L., Eur.
strictissimum, L., Eur.

Sium angustifolium, L., Eur.

Smyrnium Olusatrum, L., Eur.

Solanum Dulcamara, L., Eur.
guineense, Lam., Trop. Afr., etc.
villosum, Lam., Eur.

Solidago canadensis, L., N. Amer.

Sonchus asper, Hoffm., Eur.
oleraceus, L., Eur.
palustris, L., Eur.

Specularia falcata, A.DC., Mediter.
— var. castellana, Lange.
pentagonia, A.DC., Orient.
perfoliata, DC., N. Amer.
Speculum, A.DC., Eur.

Spergula arvensis, L., Eur.

Sphenogyne (*see* Ursinia).

Spiræa, Aruncus, L., N. Amer.
astilboides, Hort.
palmata, Thunb., Japan.
Ulmaria, L., Eur.

Stachys alpina, L., Eur.
— var. intermedia.
grandiflora, Bth., Caucas., etc. (Betonica grandiflora, L.)
spinulosa, Sib. et Sm., Greece.
sylvatica, L., Eur.

Statice densiflora, Guss., Eur.
Limonium, L., Eur.
— var. Smithii, Hort.
lychnidifolia, Gir., S. Eur.
Suworowii, Regel., Turkestan.
tomentella, Boiss., Eur., etc. (S. sareptana, Beck.)

Stipa pennata, L., Eur. Siber.

Swertia perennis, L., Eur. Cauc.

Syrenia lamarckiana, Andrz., Russia, Siberia.

Tagetes lucida, Cav., Mexico.
patula, L., Mexico.
pusilla, H.B., Quito.

Tamus communis, L., Eur.

Taraxacum corniculatum, DC., Eur.
gymnanthum, DC., Eur.

Telephium Imperati, L., Eur.

Tellima grandiflora, R.Br., N. Amer.

Tetragonia expansa, Murr., Austral.

Tetragonolobus purpureus, Mœnch, S. Eur.

Teucrium hyrcanicum, L., Cauc.
Scorodonia, L., Eur.
— var. variegatum.

Thalictrum angustifolium, Jacq., S. Eur.
— var. (T. nigricans, DC.), Eur.
aquilegifolium, L., Eur., etc.
— var. purpureum.
flavum, L., Eur.
— var.
— var. sphærocarpum, Lej.
glaucum, Desf., S. Eur.
javanicum, Blume, Java.
minus, L., Eur.
— var. affine, (Jord.)
— var. concinnum.
— var. elatum, Regel.
trigynum, Fisch., Dahur.

Thermopsis lanceolata, R.Br., Siber.
montana, Nutt., N. Amer. (fabacea, DC.)

Thlaspi alliaceum, L., Eur.
arvense, L., Eur.
alpestre, L., Eur.
præcox, Wulf., Austria.

Thrincia hirta, DC., Eur.

Thymus comosus, Heuff., Transs.
Serpyllum, L., Eur.

Tofieldia calyculata, Whlnb., Eur.

Tovaria racemosa, Neck., N. Amer.
stellata, Neck., N. Amer.

Tournefortia heliotropioides, Hook., Buen. Ayres.

Trachymene cœrulea, Graham, Austral.
pilosa, Sm., Austral.

Tradescantia erecta, Jacq., Mexico.
virginica, L., N. Amer.

Tragopogon (Geropogon glabrum, L.), S. Eur.
majus, Jacq., Eur.
orientale, L., Eur., etc.

Trifolium agrarium, L., Eur.
diffusum, Ehrh., Eur.
gemellum, Pourr., Eur.
incarnatum, L., Eur.
Lagrangei, Boiss., Orient.
leucanthum, Bbrst., Tauria, etc.
minus, Sm., Eur.
multistriatum, Koch, Eur.
pannonicum, L., Eur., etc.
Perreymondi, Gren., France.
resupinatum, L., Eur.
rubens, L., Eur.
scabrum, L., Eur.
squarrosum, L., S. Eur. (panormitanum, Pr.)
tomentosum, L., Eur.

Triglochin maritimum, L., Eur.

Trigonella corniculata, L., S. Eur.
cretica, Boiss., Crete.
fœnum-græcum, L., S. Eur.
ovalis, Boiss., Spain.
polycerata, L., Eur. (T. orthoceras, Kar. & Kir., Altai.)

Trillium grandiflorum, Salisb., N. Amer.

Trinia Hofmanni, Bbrst., Eur., etc.

Tripteris cheiranthifolia, Schultz., Abyss.

Triticum caninum, L., Eur.
chinense, Trin., N. China.
desertorum, Fisch., Russia.
durum, Desf., S. Eur., N. Afr.
monococcum, L., Eur.
ovatum, G. et G., Eur.
spelta, L.
villosum, Beauv., S. Eur.
violaceum, Horn., Eur.
vulgare, Vill., Asia.

Tritonia crocosmæflora, Garden Hybrid.
Pottsii, Benth., Cape.

Trollius asiaticus, L., Siber.
europæus, L., Eur.

Tropæolum aduncum, Sm., Peru, etc. (T. peregrinum, Jacq. T. canariense, Hort.)
majus, L., Peru.
minus, L., Peru.
tuberosum, R. et P., Peru.

Tunica illyrica, Boiss., Eur.

Tyrimnus leucographus, Cass., S. Eur.

Urospermum Dalechampii, Desf., Eur.
picroides, Desf., S. Eur.

Ursinia pulchra, N. E. Brown, Cape. (Sphenogyne speciosa, Know. et West.)
— var. sulphurea, Hort., Kew.

Urtica dioica, L., Eur.
membranacea, Poir., Eur.
pilulifera, L., Eur.
— var. balearica, L.

Valeriana alliariæfolia, Vahl, Caucas.
— var. intermedia.
officinalis, L., Eur.
— var. sambucifolia, (Mikan.)
Phu, L., S. Eur.

Valerianella Auricula, DC., Eur.
carinata, Loisl., S. Eur.
eriocarpa, Desv., Eur.
olitoria, Mœnch, Eur.

Venidium fugax, Harv., Cape.

Veratrum album, L., Eur.
nigrum, L., Eur.
viride, Ait., N. Amer.

Verbascum Blattaria, L., Eur.
phœniceum, L., Eur. Siber.
pyramidatum, Bbrst., Caucas.
speciosum, Schrad., Eur.
thapsiforme, Schrad., Eur.

Verbena caroliniana, Med., N. Amer.
bonariensis, L., S. Amer.

Veronica agrestis, L., Eur.
incana, L., S. Eur., etc.
longifolia, L., C. et S. Eur.

Veronica—*cont.*
longifolia, var. alba.
— var. mollis.
— var. rosea.
Lyallii, Hk. f., N. Zeal.
saxatilis, L., Eur.
serpyllifolia, L., Eur.
spicata, L., Eur., etc.
Teucrium, L., Eur.
— var. latifolia, (L.)
virginica, L., N. Amer.
— var. japonica, (Steud.)

Vesicaria cretica, Poir., Crete.
edentula, Poir., Eur.

Vicia amphicarpa, Dorth., France.
atropurpurea, Desf., Eur.
calcarata, Desf., Algiers.
cassubica, L., S. Eur.
Cracca, L., Eur.
disperma, DC., France.
Ervilia, Willd., S. Eur.
Faba, L., cultivated.
— var. equina, (Pers.)
fulgens, Hort.
macrocarpa, Bert., Eur.
narbonensis, L., S. Eur.
pyrenaica, Pourr., Pyren.
sativa, L., Eur., etc.
sepium, L., Eur.
sicula, Guss., Eur.
sylvatica, L., Eur.

Vicia—*cont.*
unijuga, A. Braun., Siberia. (Orobus lathyroides, L.)
villosa, Roth., S. Eur.

Vincetoxicum fuscatum, Rch. f., Eur.

Viola cornuta, L., Eur.
— var. alba.
elatior, Fr., Eur.
Jooi, Janka, Transylv.
odorata, L., Eur.
palustris, L., Eur.
striata, Ait., N. Amer.
sylvatica, L., Eur.
— var. rubra.
tricolor, L., Eur.

Wahlenbergia graminifolia, A.DC., Dalm.

Whitlavia (*see* Phacelia).

Xanthium indicum, Wall., Ind., etc. (X. orientale, L.)
strumarium, L., Eur.

Xanthocephalum gymnospermoides, B. et Hk. f., Arizona.

Zinnia multiflora, L., Mexico.

Ziziphora capitata, L., Taur., etc.

Zollikoferia elquinensis, Phil., Chili.

Zygadenus elegans, Pursh., N. Amer.

TREES AND SHRUBS.

Acer campestre, L.
— var. hebecarpum, Hort.
— var. leiocarpum.
circinatum, Pursh., N.W. Amer.
Lobelii, Ten., S. Eur.
macrophyllum, Pursh., N.W. Amer.
neapolitanum, Ten., Eur.
obtusatum, Kit., Eur.
pennsylvanicum, L., United States.

Acer—*cont.*
platanoides, L., Eur.
Pseudo-Platanus, L., Eur., etc.
— var. euchlorum.
— var. flavo-marginatum, Hort.
— var. fol. variegatum, Hort.
— var. lutescens, Hort.
— var. purpureum, Hort.

Alnus cordifolia, Ten., Italy.
glutinosa, Gærtn.
— var. rubronervia, Hort.
— var. sorbifolia, Hort.
incana, Will., N. Hemisphere.
— var. laciniata, Hort.
japonica, S. et Z., Japan.
orientalis, Dcne., Orient.
rubra, Bong., N.W. Am.
serrulata, Willd., N. Am.
— var. latifolia, Hort.

Amelanchier Botryapium, DC.
vulgaris, Mœnch, Europe.

Amorpha fruticosa, L., N. Amer.

Aralia edulis, S. et Z., Japan.

Aucuba japonica, Thunb.
vera, Hort.

Berberis aristata, DC., Himal.
buxifolia, Lamk., Chili.
concinna, Hook. f., Himalaya.
Darwinii, Hook. f., Chili.
Lycium, Royle, Himalaya.
sinensis, Desf., China.
stenophylla, Hort.
Thunbergii, DC., Japan.
virescens, Hook. f., Himalaya.
vulgaris, L., Eur., etc.
— var. dulcis, Hort.
— var. emarginata, Hort.
— var. iberica, (Stev.)
— var. purpurea, Hort.
— var. sanguinolenta, Hort.
— var. spathulata, (Schrad.)
— var. violacea, Hort.
wallichiana, DC., Himal.

Betula alba, L., N. Hemisph.
— var. Youngii, Hort.
lutea, Michx. f., N. Amer.
populifolia, Ait., U. S. Amer.

Buddleia japonica, Hemsl., Japan.

Biota orientalis, End., Orient.
— var. gracilis, Hort.
— var. intermedia, Hort.
— var. pyramidalis, Hort.
— var. prostrata, Hort.

Calophaca wolgarica, Fisch., S. Russia.

Caragana arborescens, Lamb., Siberia.
frutescens, DC., Siberia.
— var. pendula, Hort.
pygmæa, DC., Siberia.
— var. aurantiaca.
Redowskii, DC., Siberia.

Carpinus Betulus, L., Eur., etc.

Catalpa speciosa, Ward., N. Amer.

Celastrus scandens, L., N. Amer.

Celtis occidentalis, L., N. Amer.

Cephalostachyum capitatum, Munro, Sikkim.

Cerasus lusitanica, Lobel., Portugal.

Chamæcyparis (Cupressus).
Lawsoniana, Parl., Calif.
obtusa, S. et Z., Japan.
(Retinospora obtusa.)

Cistus laurifolius, L., Spain.

Cladrastis amurensis, Benth. et Hook., Amur.

Clematis erecta, L., Europe, etc.

Colutea arborescens, L., Eur.
— var. cruenta, (Ait.)
— var. haleppica, (Lamk.)

Cornus alba, L., N. Amer.
alternifolia, L. f., N. Amer.
pubescens, Nutt., N. Amer.
sanguinea, L., Eur.
sericea, L., N. Amer.
sibirica, Lodd., Siberia, etc.

Cotoneaster acuminata, Lindl., Himal.
bacillaris, Wall., Himal.
— var. floribunda, Hort.
— var. obtusa, Hort.
buxifolia, Wall., Himal.
Fontanesi, Spach.
frigida, Wall., Himal.
horizontalis, Dcne.
microphylla, Wall., Himal.
nummularia, F. et M., Asia, etc.
rotundifolia, Wall., Himal.
Simonsii, Baker., Himal.
tomentosa, Lindl., Eur.
vulgaris, Lindl., Europe.

Cratægus brachyacantha, Eng. et Sarg., N. Amer.
Carrierei, Vauvel. (C. Lavallei, Herincq.)

Cratægus—*cont.*
coccinea, L., N. Amer.
— var. acerifolia, Hort.
— var. corallina, Hort.
— var. glandulosa, Hort.
— var. indentata, Hort.
— var. Kelmanni, Hort.
— var. mespilifolia, Hort.
— var. neapolitana, Hort.
— var. subvillosa, Hort.
cordata, Mill., N. Amer.
Crus-Galli, L., N. Amer.
— var. prunifolia, (Pers.)
— var. splendens, Hort.
Douglasii, Lindl., N. Amer.
Downingii, Hort.
heterophylla, Flugge.
macracantha, Lodd.
nigra, W. et K., E. Eur.
olivieriana, Bosc., Asia Minor.
orientalis, Pall., Orient.
Oxyacantha, L., Eur.
— var. eriocarpa, Hort.
— var. flexuosa, Hort.
— var. fusca, Hort.
— var. Gumperi bicolor, Hort.
— var. monogyna, (Jacq.)
— var. pendula, Hort.
— var. pentagyna, Hort.
— var. punicea, Hort.
— var. Reginæ, Hort.
— var. semperflorens, Hort.
— var. spinosissima, Hort.
— var. stricta, Hort.
parvifolia, Ait., N. Amer.
punctata, Jacq., N. Amer.
— var. brevispina, Hort.
— var. striata, Hort.
Pyracantha, Pers., var. Lalandii, Hort.
sanguinea, Pall., Siberia, etc.
— var. songorica.
tanacetifolia, Pers., Orient.
tomentosa, L., N. Amer.

Cytisus albus, L., S.W. Eur.
— var. incarnatus, Hort.
capitatus, Jacq., S. Eur.
biflorus, L., Herit., Eur.
leucanthus, W. et K., E. Eur.
× præcox, Hort.
nigricans, L., Eur.
— var. longispicatus.
purpureus, Scop., E. Eur.
scoparius, L., Eur.

Cytissus—*cont.*
scoparius, var. pendula, Hort.
sessilifolius, L., Eur.

Dabœcia polifolia, D. Don., W. Eur.
— var. alba.
— var. versicolor.

Deutzia crenata, S. et Z., Japan.
— var. Sieboldii, Hort.
scabra, Thunb., Japan.

Elæagnus longipes, A. Gray., Japan.
umbellata, Thunb., Japan.

Erica cinerea, L., var. atrosanguinea.
— var. coccinea.
— var. grandiflora.
— var. purpurea.
— var. rosea.
stricta, Andr., S. Eur.

Euonymus europæus, L., Eur.
— var. coccineus, Hort.
latifolius, Scop., Eur.

Fraxinus Ornus, L., Eur.
— var. latifolia, Hort.
— var. rotundifolia, Hort.
excelsior, L., var. simplicifolia, Hort.

Garrya eliptica, Dougl., California.

Gaultheria Shallon, Pursh., N. Amer.

Genista ætnensis, DC., Sicily.
pilosa, L., Eur.
radiata, Scop., S. Eur.
sagittalis, L., Eur.
tinctoria, L., var. elatior.
virgata, DC., Madeira.

Hamamelis virginica, L., N. Amer.

Hedera Helix, L., Eur., etc.

Hippophae rhamnoides, L., Eur., etc.

Hypericum Androsæmum, L., Eur.
elatum, Ait., N. Amer.

Ilex Aquifolium, L., Eur.
— var. platyphylla, Hort.
verticillata, Gray., N. Amer.

Kalmia glauca, Ait., N. Amer.
latifolia, L., N. Amer.

Laburnum alpinum, Griseb., Eur.
Alschingeri, Vis., E. Eur.
vulgare, Griseb., Eur.
— var. aureum, Hort.
— var. Carlieri, Hort.
— var. involutum, Hort.
— var. Parkesi, Hort.
— var. quercifolium.
— var. sessilifolium.

Ledum palustre, L., Eur., etc.
latifolium, Ait., N. Amer.

Leycesteria formosa, Wall., Himal.

Ligustrum vulgare, L., Eur., etc.

Lonicera discolor, Lindl., Himal.
flava, Sims., N. Amer.
flexuosa, Thunb., Japan.
Morrowii, Gray., Japan.
occidentaliis, Steud., N. Amer.
orientalis, Lam., Asia Minor.
Xylosteum, L., Eur.

Lyonia ligustrina, DC., N. Amer.

Magnolia tripetala, L., N. Amer.

Mahonia Aquifolium, Nutt.
— var. murrayana, Hort.
fascicularis, DC., N. Amer.

Menispermum canadense, L., N. Amer.

Mespilus Smithii, DC., Caucasus.

Morus nigra, L., Eur.

Myrica cerifera, L., United States.

Neillia amurensis (Spiræa, Maxim.), Amurland.
opulifolia, Benth. et Hook., N. Amer.

Olearia Haastii, Hook. fil., N. Zeal.

Pernettya mucronata, Gaud., Chili, etc.

Piptanthus nepalensis, Sweet., Himalaya.

Pourthiæa arguta, DC., Himalaya.

Prunus brigantiaca, Vill., S. Eur.
maritima, Wang., N. Amer.

Ptelea trifoliata, L., N. Amer.
— var. aurea, Hort.
— var. glauca, Hort.
— var. mollis.

Pyrus americana, DC., N. Amer.
Aria, Ehrh.
— var. græca, Boiss.
— var. salicifolia.
arbutifolia, L., N. Amer.
— var. grandiflora, Hort.
— var. serotina, Lindl.
Aucuparia, Gærtn., Eur.
— var. pendula, Hort.
— var. saturejifolia.
cordata, Desv., Europe.
— var. piriformis.
floribunda, Sieb., Japan.
intermedia, Ehrh., Europe.
latifolia, Syme, Europe.
Maulei, Masters, Japan.
— var. superba, Hort.
nivalis, Jacq., Asia Minor.
prunifolia, Willd., Asia.
Ringo, Max., Japan, etc.
spectabilis, Desf., China, etc.

Rhamnus carolinianus, Walt., S. United States.

Rhododendron arboreum, Sm., Sikkim.
campanulatum, Don, Sikkim.
ciliatum, Hook. f., Sikkim.
fulgens, Hook. f., Sikkim.
Maddeni, Hook. f., Sikkim.
Wightii, Hook. f., Sikkim.

Rhodotypus kerrioides, S. et Z., Japan.

Rhus radicans, L., N. Amer.
typhina, L., N. Amer.

Ribes alpinum, L., Eur.
aureum, Pursh., var. præcox, Hort.
sanguineum, Pursh., N.W. Amer.
— var. atrorubens, Hort.
— var. atrosanguineum, Hort.
— var. glutinosum, Benth.

Rosa acicularis, Lindl., Japan, etc.
agrestis, Savi, Eur.
Alberti, Rgl., E. Asia.
alpina, L., Eur.
— var. inermis.
Bakeri, Déségl., England.
beggeriana, Schrenk., Asia.
belgradensis, Hort.
blanda, Ait., N. Amer.
californica, Ch. et Sch., Calif.
canina, L., Eur., etc.
— var. andegavensis, Baker.

Rosa—*cont.*
  canina, var. Kotschyana, Hort.
  carolina, L., N. Amer.
  cinnamomea, L., Eur., etc.
  hibernica, Sm., Britain.
  — var. vera.
  lucida, Ehrh., N. Amer.
  microcarpa, Hort.
  microphylla, Roxb., China.
  mollis, Sm., Eur.
  multiflora, Thunb., Japan.
  nutkana, Presl., N. Amer.
  omissa, Déségl., Eur.
  pisocarpa, A. Gray, N, Amer.
  pomifera, Herrm., Europe.
  rubiginosa, L., Europe, etc.
  — var. major, Hort.
  rubrifolia, Vill., Eur.
  rugosa, S. et Z., Japan.
  — var. alba.
  sericea, Lindl., Himal.
  spinosissima, L., Eur.
  — var. cistiflora, Hort.
  — var. picta, Hort.
  — var. rubra, Hort.
  tomentosa, Sm., Eur., etc.
  Wilsoni, Bor., Britain.

Rubus laciniatus, Willd., Hort.
  leucostachys, Sm., Eur.
  occidentalis, L. et N., Amer.
  rhamnifolius, W. et N., Eur.
  rusticanus, Merc., Brit.
  strigosus, Michx., N. Amer.
  suberectus, Anders., Europe.
  ulmifolia, Schott (R. discolor, W. et N.), Eur.

Sambucus nigra, L., Eur.
  — var. aurea, Hort.
  — var. swindonensis, Hort.
  — var. virescens, Hort.

Skimmia Fortunei, Mast. (S. japonica, Hort.)

Smilax rotundifolia, L., N. Amer.

Spiræa bella, Sims., Himalaya.
  canescens, Don., Himal.
  carpinifolia, Pall., Eur.
  Douglasii, Hook., N.W. Amer.
  japonica, L. fil., Japan.
  — var. flore albo.
  — var. glabra, Hort.
  — var. typica.
  — var. ruberrima, Hort.
  lindleyana, Wall., Himal.
  luxurians, Lavallée (S. pruinosa, Hort.
  nobleana, Hook., California.
  paniculata, L.
  — var. rosea.
  salicifolia, L., N. Amer.
  splendens, Hort.

Staphylea pinnata, L., Eur.

Symphoricarpus racemosus, Michx. N. Amer.

Syringa pekinensis, Rupr., China.
  vulgaris, L., Orient.

Taxus baccata, L., Eur., etc.
  — var. Dovastonii, Hort.
  — var. fructu-luteo, Hort.
  — var. Washingtoni, Hort.

Ulex europæus, L., Eur.

Vaccinium maderense, Link., Azores.
  stamineum, L., N. Amer.

Viburnum Opulus, L., Eur., etc.
  cassinoides, N. Amer.
  Lantana, L., Eur.

Zenobia speciosa, D. Don., U. S. Amer.
  — var. pulverulenta.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX II.—1893.

NEW GARDEN PLANTS OF THE YEAR 1892.

The number of garden plants annually described in botanical and horticultural publications, both English and foreign, is now so considerable that it has been thought desirable to publish a complete list of them in the *Kew Bulletin* each year. The following list comprises all the new introductions recorded during 1892. These lists are indispensable to the maintenance of a correct nomenclature, especially in the smaller botanical establishments in correspondence with Kew, which are, as a rule, only scantily provided with horticultural periodicals. Such a list will also afford information respecting new plants under cultivation at this establishment, many of which will be distributed from it in the regular course of exchange with other botanic gardens.

The present list includes not only plants brought into cultivation for the first time during 1892, but the most noteworthy of those which have been re-introduced after being lost from cultivation. Other plants included in the list have been in gardens for several years, but either were not described or their names had not been authenticated until recently.

In addition to species and botanical varieties, all hybrids, whether introduced or of garden origin, but described for the first time in 1892, are included. It has not been thought desirable, however, to give authorities after the names of garden hybrids in such genera as Cypripedium, &c. Mere garden varieties of such plants as Coleus, Codiæum, or Narcissus are omitted for obvious reasons.

In every case the plant is cited under its published name, although some of the names are doubtfully correct. Where, however, a correction has appeared desirable this is made.

The name of the person in whose collection the plant was first noticed or described is given where known.

An asterisk is prefixed to all those plants of which examples are in cultivation at Kew.

The publications from which this list is compiled, with the abbreviation used to indicate them, are as follows :— *B. M.*— Botanical Magazine. *B. T. O.*—Bulletino della R. Società Toscana di Orticultura. *Bull Cat.* — Bull, Catalogue of New, Beautiful, and Rare Plants. *Gard.*—The Garden. *G. C.* — Gardeners' Chronicle. *G. and F.*—

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Garden and Forest. *Gfl.*—Gartenflora. *G. M.*—Gardeners' Magazine. *Ill. H.* — L'Illustration Horticole. *Jard.*—Le Jardin. *J. of H.*—Journal of Horticulture. *J. O.*—Journal des Orchidées. *L.*—Lindenia. *O.*—L'Orchidophile. *R. H.* — Revue Horticole. *R. H. B.* — Revue de l'Horticulture Belge. *Veitch Cat.*—Veitch & Sons, Catalogue of Plants. *W. G.*—Wiener Illustrirte Garten-Zeitung. *Williams Cat.*—Williams, New and General Plant Catalogue. *W. O. A.*—Warner & Williams, Orchid Album.

The abbreviations in the descriptions of the plants are:—*Diam.*—Diameter. *Fl.*—Flower. *Fr.*—Fruit. *Ft.*—Foot or Feet. *G.*—Greenhouse. *H.*—Hardy. *H. H.*—Half-hardy. *In.*—Inches. *Infl.*—Inflorescence. *L.*—Leaves. *Lin.*—Line (one-twelfth of an inch). *Per.*—Perennial. *Pet.*—Petals. *S.* — Stove. *Sep.*—Sepals. *Shr.*—Shrub.

Acer palmatum, Thbg. var. **Aokii,** Späth. (*Gfl.* 1892, p. 33, t. 1363.) Sapindaceæ. H. tree. A form with variegated foliage. Garden variety. (Späth.)

Acer Trautvetteri, Medw. var. **erythrocarpa,** Dieck. (*Cat. Nat. Arb. Zösch.* 1892, p. 11.) H. tree. A variety with red fruit. Caucasus. (Zöschen Arboretum.)

Adiantum elegantissimum, Hort. (*G. C.* 1892, v. xii., p. 249.) Filices. S. A sport from *A. cuneatum.* (H. B. May.)

Adiantum macrophyllum, Swartz var. **albostriatum.** (*G. C.* 1892, v. xi., p. 816.) S. A variety with the pinnæ streaked with creamy white on a green ground. (T. & J. Rogers.)

***Agapetes Mannii,** Hemsl. (*G. C.* 1892, v. xii., p. 364.) Vacciniaceæ. G. A new species with small crowded l., and small inconspicuous fl., similar to those of *A. obovata.* Khasia. (Kew.)

***Agave Franzosini,** Baker. (*Kew Bull.* 1892, p. 3; *G. C.* 1892, v. xii., p. 179, fig. 31.) Amaryllideæ. G. A new species of the dimensions and habit of *A. americana*; l. intensely glaucous, forming a rosette 18 ft. across; panicle candelabrum-like, 40 ft. high, fl. green and yellow. (T. Hanbury.)

***Aglaonema costatum,** N. E. Br. (*G. C.* 1892, v. xi., p. 426.) Aroideæ. S. A pretty stove foliage plant with ovate green l. spotted and veined with white; scape short, spathe small, green. Perak. (J. Veitch & Sons.)

***Albuca Buchanani,** Baker. (*G. C.* 1892, v. xii., p. 488.) Liliaceæ. G. A new species nearly allied to *A. Wakefieldii,* with small ovoid bulbs, linear l., and a long thin scape bearing a raceme of yellow fl. Nyassaland. (Kew.)

***Alloplectus Lynchei,** Hook.f. (*B.M.* t. 7271.) Gesneraceæ. S. A new species with fleshy stems, purplish, oblong-lanceolate, crenate l., and axillary clusters of tubular, hairy, yellow fl. with large calyces tinged with red. New Grenada? (Cambridge Botanic Garden.)

Alocasia Dussii, Damm. (*Gfl.* 1892, p. 412.) Aroideæ. S. Aroid with large olive-green l. with brownish-red nerves and petioles. (Dammann & Co.)

Alocasia nobilis. (*G. C.* 1892, v. xi., p. 731.) Name only. (F. Sander & Co.)

Alocasia Rex. (*G. C.* 1892, v. xi., p. 731. Name only. (F. Sander & Co.)

***Aloe aurantiaca,** Baker. (*G. C.* 1892, v. xi., p. 780.) Liliaceæ. G. A new species intermediate between *A. arborescens* and *A. ciliaris.* Stem $\frac{3}{4}$-in. in diameter, l. 9 in. long, $1\frac{1}{2}$ in. wide, apple-green, the margins spinous. Peduncles as long as the leaves, fl. in a dense raceme, yellow tinged with red. S. Africa. (T. Hanbury.)

Ampelovitis Romaneti, Carr. (*R. H.* 1892, p. 94.) Ampelideæ. G. A vine with lobed l., glaucous beneath, and narrow bunches of black grapes. China?

Androsace albana, Stev. (*G. C.* 1892, v. xii., p. 399.) Primulaceæ. A handsome hardy perennial species, forming small rosettes of bright green, toothed l. Fl. in umbels, pinkish. April, July. E. Caucasus. (Correvon.)

Androsace caucasica, Somnier and Levier. (*G. C.* 1892, v. xii., p. 399.) H. A pretty perennial species, with dense rosettes of narrow toothed l. Fl. almost stemless in clusters, bright pink. Summer. Caucasus. (Correvon.)

***Angræcum obrienianum,** Hort. Sander. (*G. C.* 1892, v. xi., p. 816.)

Orchideæ. S. A thick-leaved species allied to *A. chailluanum*, with greenish-white long-spurred flowers. (F. Sander & Co.)

Anguloa uniflora, R. and P. var. **Treyerani,** Rolfe. (*L.* v. 7, p. 47, pl. 310.) Orchideæ. G. A variety having the base of the lip marked with more numerous rosy bars than usual. Andes. (L'Horticulture Internationale.)

Anthurium andreanum, Lind. var. **wambekeanum,** Rodigas. (*Ill. H.* v. 39, p. 109, pl. 163.) Aroideæ. S. A variety with white spathes. (C. Van Wambeke.)

Anthurium greyanum. (*G. and F.* v. 5, p. 526.) S. A garden hybrid between *A. ornatum* and *A. andreanum*. (W. Grey, New York.)

Anthurium Lawrenciæ. (*G. C.* 1892, xi., p. 731.) S. A garden hybrid. (F. Sander & Co.)

Anthurium rosæflorum. (*G. C.* 1892, xi., p. 731.) Name only. (F. Sander & Co.)

***Aquilegia transsilvanica,** Schur. (*G. C.* 1892, v. xi., p. 650.) Ranunculaceæ. H. perennial 1–2 ft. high, branching, and quite glabrous, l. biternate, segments 2–3 fid. Fl. 2–3 in. in diam. bright purplish-blue. May. Transylvania. (Kew.) The correct name of this is *A. glandulosa,* Fisch.

Aristolochia clypeata, Linden and André. (*G. C.* 1892, v. xi., p. 435, fig. 61.) Aristolochiaceæ. S. A handsome species allied to *A. Duchartrei*, with large cream-yellow fls., blotched and lined with purple. L. large, ovate, green. It is similar to *A. gigantea*. (L'Horticulture Internationale.)

***Astilbe chinensis,**Fr. and Sav. (*Gard.* 1892, v. xlii., p. 221.) Saxifrageæ. A fine hardy plant resembling *A. japonica*, but with more loosely branched inflorescence, and rose-coloured fl. September. China. (Kew.)

***Asystasia varia,** N. E. Br. (*G. C.* 1892, v. xii., p. 760.) Acanthaceæ. S. A new species which forms a small shrub less than a ft. in height, with 4-angled stems, ovate or lanceolate l., and short axillary racemes of tubular, 2-lipped, mauve and brown fl. Zululand. (Kew.)

Athyrium setigerum, Hort. (*G. C.* 1892, v. xii., p. 249.) Filices. Name only. (J. & W. Birkenhead.)

***Beaufortia sparsa,** Br. (*Bot. Mag.* t. 7231.) Myrtaceæ. G. This is the correct name for the plant cultivated in England under the name of *B. splendens*, Paxt.

Begonia cinnabarina, Hook. var. **albovittata,** Rodigas. (*Ill. H.* v. 39, p. 119, t. 165.) Begoniaceæ. G. A garden variety having the pet. striped with white. (Blancquaert & Vermeirin.)

Begonia decora, Stapf. (*G. C.* 1892, v. xii., p. 621 ; *G. and F.* v. v. p. 561.) S. A new species with a short fleshy stem, crowded with ovate leaves 5 in. long, 3 in. wide, coloured coppery-red with yellowish veins. Flowers pink. Perak. (J. Veitch & Sons.)

***Begonia Duchartrei,** Bruant. (*R. H.* 1892, p. 29, f. 7. *Gard.* 1892. v. 6, p. 115, with fig.) S. A garden hybrid between *B. echinosepala* and *B. scharffiana*. (Bruant.)

***Begonia glaucophylla,** Hook. f. (*B. M.* t. 7219.) S. A well-known garden plant, the history and description of which were published along with a figure in the Botanical Magazine last year. Brazil.

***Begonia Gloire de Lorraine** (*G. and F.* v. v. p. 244, fig. 48.) G. A garden hybrid between *B. socotrana* and *B. Dregei*. (Lemoine.)

Begonia rosea-multiflora, Hort. (*G. C.* 1892, v. xii., p. 249.) S. A variety of *B. semperflorens*. (Vilmorin.)

Bomarea sororia, N. E. Br. (*Ill. H.* v. 39, p. 19, pl. 145.) Amaryllideæ. G. Climber, resembling *B. edulis*, with ovate accuminate l., pubescent beneath, and lax umbels of about 20 fl., having the outer segments a little shorter than the inner ones, rosy spotted with carmine, the inner segments green spotted with brown. S. America. (L'Horticulture Internationale.)

***Buddleia Colvillei,** Hk. f. (*G. C.* 1892, v. xi., p. 789 ; and v. xii., p. 186, fig. 32.) Loganiaceæ. H. H. Not new to cultivation, but flowered for the first time in Europe, it is said, by Mr. Gumbleton in his garden at Cork last year. It is a beautiful shrub with loose bunches of rose-coloured bell shaped fl. (Himalayas.)

Bulbophyllum anceps, Rolfe. (*L.* v. 8, p. 33, pl. 351.) Orchideæ. S. An elegant species with very broad compressed bulbs, oblong obtuse l., and lax racemes of moderate-sized fl. Dorsal sep. and pet. yellowish dotted with purple, side sep. white striped with purple, lip purple. Borneo. (L'Horticulture Internationale.)

***Bulbophyllum comosum,** Hemsl. (*Gard.* 1892, v. xli., p. 48 ; *J. of H.*

1892, v. xxiv., p. 141, fig. 21.) S. A pretty little species with clustered Pleione-like pseudobulbs, fleshy deciduous l., and erect scapes 6 in. long, with abruptly reflexed dense racemes of white hairy fl., which develop after the l. have fallen. Burma. (Kew.)

Bulbophyllum elegans, Gardn. (*G. C.* 1892, xi., p. 764.) S. An attractive species with small ovoid bulbs, crowded along the stems, narrow lanceolate l., and slender scapes bearing one fl. about an inch long, with broad rosy-purple sep., the upper one shorter and paler than the others. Ceylon. (Sir T. Lawrence.)

***Bulbophyllum obrienianum,** Rolfe. (*G. C.* 1892, v. xii., p. 332.) S. A new species of the *Sarcopodium* group, with a stout rhizome, ovoid one-leaved pseudobulbs and solitary fl. nearly 2 in. in diameter, yellow with dark reddish-purple spots. Himalaya. (J. O'Brien.)

Calanthe sanderiana, Rolfe. (*G. C.* 1892, v. xii., p. 396.) Orchideæ. S. A new species quite distinct from *C. sanderiana*, Williams, which is a var. of *C. vestita*. It is allied to *C. natalensis*, but with larger fl. and a deeper coloured lip. L. lanceolate, petiolate, 20 in. long, 4 in. broad, scapes 2 ft. long, bearing numerous flowers. East Tropical Africa. (F. Sander & Co.)

Calanthe vestita var. **Fournieri,** Rolfe. (*G. C.* 1892, v. xi., p. 488.) S. A variety with smaller flowers than the type. Borneo. (Fournier.)

Calla Pentlandi, Hort. *See* **Richardia Pentlandi.**

Calochortus amœnus. (*G. C.* 1892, v. 12, p. 11.) Liliaceæ. H. H. Intermediate in habit between *C. alba* and *C. pulchella*. Fl. deep rosy-pink, or purple. L. lanceolate, vigorous. July. (Van Tubergen.)

***Calochortus Kennedyi,** Porter. (*B. M.* tab. 7264; *Gard.* 1892, v. xlii., p. 15.) H. H. A very handsome species with bright scarlet flowers, the black spots near base being surrounded with bristles. L. linear. July. California. (Kew.)

***Caralluma campanulata,** N. E. Br. (*G. C.* 1892, v. xii., p. 369; *B. M.* 7274.) Asclepiadeæ. S. succulent. A dwarf Stapelia-like plant, with 4-angled glabrous stems, and terminal umbels of star-shaped fl., 1 in. in diam., velvety brownish-purple. Ceylon. (Kew.)

***Carex gracilis,** R. Br. (*R. H.* 1892, p. 384.) Cyperaceæ. G. sedge of graceful habit with narrow bright green l., and narrow panicles of slender clustered spikes. Japan, India, Australia. (Muette.) This may be *C. tristachys*, known in gardens as *C. japonica*.

***Carludovica micropetala,** Hook. f. (*B. M.* t. 7263.) Cyclanthaceæ. S. A dwarf species with a short fleshy stem, narrow dark green plicate l. 1½ ft. long, split from the apex to below the middle; peduncle 4 in. long, sheaths 1 in. long, spadix 1 in. long, covered with pale yellow fl. and long white filaments. Costa Rica. (Kew.)

Catasetum Liechtensteinii, Kränzlin. (*G. C.* 1892, v. xi., p. 171.) Orchideæ. S. A new species allied to *C. Trulla*, with a raceme of 20 green and brown fl., each 2 in. across.

***Cattleya Alexandræ,** Rolfe. (*G. C.* 1892, v. xi., p. 523, and v. xii., 672; *R. H. B.* 1892, p. 196, f. 19; *I. O.* vol. 3, p. 168, f. 3.) Orchideæ. S. A new species, very similar in general characters to *C. Leopoldii*, but with dull brown fl., the lip only being rosy-purple. Brazil. (L'Horticulture Internationale.)

Cattleya Amesiæ, Hort. Sander. (*G. C.* 1892, v xi., p. 816.) A garden hybrid. (F. Sander & Co.)

Cattleya aurea, Linden. var. **statteriana.** (*G. C.* 1892, v. xii., p. 379.) S. A form of *C. labiata*, var. *dowiana*, with less crimson colour on the lip than usual. Syn. *C. statteriana* (*J. of H.* 1892, v. 25, p. 277, f. 38.) (T. Statter.)

Cattleya Baroness Schroederæ. (*G. C.* 1892, v. xii., p. 249.) S. A garden hybrid between *C. labiata* var. and *C. jongheana* (*dolosa*). (Baron Schroeder.)

Cattleya Batalinii, Kränzlin. (*G. C.* 1892, v. xii., pp. 75, 332.) S. A new species recalling *C. schilleriana*. Fl. 2½ in. across, purplish rose, side lobes of lip whitish, mid-lobe deep purple; column very large. Brazil. (F. Sander & Co.)

Cattleya blesensis, Maron. (*R. H.* 1892, p. 416.) G. A garden hybrid between *C. pumila* and *C. Loddigesii*. (Maron.)

Cattleya burberryana. (*G. C.* 1892 v. xi., p. 535.) S. A garden hybrid between *C. imbricata* × and *C. superba*. (F. Sander & Co.)

Cattleya hardyana, Rchb. f. var. **gardeniana,** Hort. (*L.* v. 8, p. 37, pl. 353.) S. A fine form with rose-coloured sep. and pet., and a yellow lip with the apical part deep magenta-purple. (Garden.)

Cattleya labiata, Lindl. var. **marmorata.** (*G. C.* 1892, v. xi., p. 816.) S. A variety of the plant known in gardens as *C. Warneri*, with mottled flowers. (J. T. Gabriel.)

Cattleya labiata, Lindl. var. **Sanderæ.** (*G. C.* 1892, v. xii., p. 567 ; *Gard.* xlii., p. 417.) S. A large-flowered variety with blush-white segments and a deep crimson labellum, margined with white. (F. Sander & Co.)

Cattleya leucoglossa. (*G. C.* 1892, v. xii., p. 566 ; *J. of H.* 1892, v. xxv., p. 413, fig. 56.) S. A garden hybrid between *C. fausta* × and *C. Loddigesii.* (J. Veitch & Sons.)

Cattleya Minacia. (*G. C.* 1892, v. xii., p. 379.) S. A garden hybrid between *C. Loddigesii* and a variety of *C. labiata.* (J. Veitch & Sons.)

Cattleya oweniana, Hort. Sand. (*G. C.* 1892, v. xii., p. 312 ; *J. of H.* 1892, xxv., p. 241, fig. 33.) S. A variety of *C. labiata,* and not unlike that known as *hardyana.* It has creamy-white sepals and petals, and a lip richly marked with crimson and gold. (F. Sander & Co.)

Cattleya Philo. (*G. C.* 1892, v. xi., p. 535.) S. A garden hybrid between *C. iricolor* and *C. Mossiæ.* (J. Veitch & Sons.) Var. **albiflora,** p. 598.

Cattleya Princeps, Hort. Sander. (*G. C.* 1892, v. xi., p. 816.) S. A dull coloured variety of *C. schofieldiana.*

Cattleya schilleriana, Rchb. f. var. *Lowii.* (*G. C.* 1892, v. xii, p. 138 ; *J. of H.* 1892, v. xxv., p. 187, fig. 26.) S. A variety with fl. of a pleasing lavender-blue, the lip being streaked with a darker shade of the same colour. (H. Low & Co.)

Cattleya schröderiana, Rchb. f. var. **leyswoodiensis.** (*J. of H.* 1892, v. xxiv., p. 397, fig. 69.) S. A variety remarkable for the width and crispness of its segments, which are nearly pure white, with a blotch of orange in the throat. (J. W. Temple.)

Cattleya speciosissima, Hort. var. **sanderiana.** (*G. C.* 1892, v. xii., p. 312.) S. "One of the handsomest and purest of white Cattleyas." (W. R. Lee.)

Cattleya statteriana, Hort. (*G. C.* 1892, v. xii., p. 378 ; *J. of H.* 1892, v. xxv., p. 277, fig. 38.) *See* **C. aurea,** var. **statteriana.**

***Cattleya Victoria-regina,** O'Brien. (*G. C.* 1892, v. xi., p. 586 and 809, figs. 115–116 ; *R. B. H.* 1892, p. 198, f. 20.) S. A new species very similar to *C. Leopoldi* in pseudobulb, leaf, and inflorescence. It is described as having from six to twenty flowers on a spike, each six inches across with reddish segments and a white lip, lined with rose and blotched with crimson, Brazil. (F. Sander & Co.)

Cerastium decalvans, Schloss & Vuk. (*G. C.* 1892, v. xii., p. 615.) Caryophylleæ. H. perennial. An interesting species, with sub-ligneous stems, and leaves covered with tufts of wool. Fl. white, numerous. May, June. Servia. (Correvon.)

***Chamœdorea stolonifera,** Wendl. (*B. M.* t. 7265.) Palmæ. S. A dwarf palm with stems a yard high, ½ in. thick, stoloniferous ; l. 10 in. long, plicate, bilobed, green ; spadices axillary, branched, fl. yellow. South Mexico. (Kew.)

***Cheiranthera parviflora,** Benth. (*B. M.* t. 7261.) Pittosporeæ. G. An elegant twiner with the habit of *Sollya heterophylla,* the stems being wiry, the l. linear, and the fl. solitary on short lateral branches, 1 in. across, star-shaped, purple. W. Australia, (Kew.)

***Chionodoxa Luciliæ,** Boiss, var. **Alleni.** Whittall. (*Gard.* 1892, v. xlii., p. 17.) Liliaceæ. H. A beautiful large-flowered form, with blue, white and pink fl. March. Mt. Taurus. (Whittall, Kew.)

***Chirita depressa,** Hook. f. (*B. M.* t. 7213.) Gesneraceæ. S. A dwarf species with a short rhizome, rosulate green spathulate l. and stoloniferous habit. Fl. tubular, Gloxinea-like, purple. China. (Kew.)

Cirrhopetalum amesianum, Rolfe. (*L.* v. 7, p. 51, pl. 314.) Orchideæ. S. An attractive species, with 4-angled bulbs, broad l., and umbels of rather large fl. The connate sepals are yellowish white, shaded with rosy-purple at the base, and the rest of the fl. is yellow. Dutch Indies. (L'Horticulture Internationale.)

Cœlogyne cuprea, Kränzlin. (*G. C.* 1892, v. xi., p. 619.) Orchideæ. S. A new species, with long onion-shaped bulbs, oblong l., and flower-stalks bearing five to eight bracts and drooping fl., which somewhat resemble a reduced fl. of *C. speciosa.* (F. Sander & Co.)

***Colchicum Bornmülleri,** Hauss. (*G. C.* 1892, v. xii., p. 471.) Liliaceæ. H. Resembling *C. speciosum,* of which it may be a mere geographical form. May. Orient. (Kew.)

Colchicum Decaisnei, Boiss. (*B. T. O.* 1892, p. 132; *G. C.* 1892, v. 12, p. 458.) Liliaceæ. H. bulb, allied to *C. lætum,* with large rosy-purple fl. Lebanon. (Dammann & Co.)

Coleus Penzigii, Damm. (*Gfl.* 1892, p. 525.) Labiatæ. S. A bushy species with large emerald-green, thick, fleshy l., and long spikes of blue fl. Abyssinia. (Dammann & Co.)

Colutea melanocalyx, Boiss. (*G. C.* 1892, v. xii., p. 669.) Leguminosæ. H. A near ally of *C. arborescens,* principally differing in the calyx and pedicels being clothed with short dark-coloured hairs. Asia Minor.

***Cornus Kousa,** Buerg. (*G. C.* 1892, v. xi., p. 816; *J. of H.* 1892, v. xxv., p. 11, f. 2.) Cornaceæ. H. shr. This is the plant that is known as *Benthamia japonica,* S. & Z. (J. Veitch & Sons.)

Coryanthes macrocorys, Rolfe. (*L.* v. 8, p. 15, pl. 342.) Orchideæ. S. A very distinct species with large, pale yellowish-white fl., spotted and dotted with purple, and having a very elongate, thimble shaped hood at the base of the lip, streaked with purple. Peru. (L'Horticulture Internationale.)

Cosmos spectabilis, Carr. (*R. H.* 1892, p. 372, f. 114–115, and coloured pl.) Compositæ. H. annual. Garden hybrid.

***Costus englerianus,** Schumann. (*G.C.* 1892, v. xii., pp. 789, 696.) Scitamineæ. S. A new species with short decumbent stems, elliptic, obtuse, fleshy, dark green l. and sessile spikes of small white and yellow fl. Syn. *C. unifolius,* N. E. Br. Trop. Africa. (Kew.)

Costus lucanusianus, Br. & Sch. (*Gfl.* 1892, p. 481, t. 1379.) S. A tall growing species, with lanceolate acuminate l., white beneath, and terminal heads of purple fl. with a yellow middle lobe to the lip. Cameroons. (Berlin Botanic Garden.)

Crassula Schweinfurthii, Damm. (*Gfl.* 1892, p. 525.) Crassulaceæ. S. succulent. A dwarf tufted species with white fl. Abyssinia. (Dammann & Co.)

***Crinum abyssinicum,** Hochst. (*Gfl.* 1892, p. 412, f. 89.) Amaryllideæ. G. or H. H. bulb, with erect bluish-green l., and umbels of long-tubed, fragrant, white fl. Abyssinia. (Dammann & Co.)

***Crinum firmifolium,** Baker. (*G. C.* 1892, v. xi., p. 362.) S. bulb with lorate l. 3 ft. long by 1½ in. broad. A scape 1 ft. long, bearing an umbel of eight flowers which are 6 in. long with narrow white (?) segments. Madagascar.

***Crinum jemense,** Defl. (*B. T. O.* 1892, p. 133, f. 6.) G. bulb. A handsome species with broad shining green l., and large umbels of pure white fl. Arabia. (Dammann & Co.)

Crinum yuccæfolium, Damm. (*Gfl.* 1892, p. 525.) G. bulb very similar to *C. abyssinica,* but smaller in every part. Abyssinia. (Dammann & Co.)

***Crocus Billiotii,** Maw. (*Gard.* 1892, v. xli., p. 116.) Irideæ. H. Allied to *C. aërius,* differing in having a basal spathe, and no rings on the corm-tunic. Fl. dark rich purple, with darker blotch near the throat. February. Stauros. (Kew.)

Crocus hyemalis, Boiss. var. **Foxii** (Boiss.). (*Gard.* 1892, v. xli., p. 18.) H. A handsome variety, with white fl. having a yellow throat and black anthers. January. (Burbidge.)

***Curcuma bakeriana,** Hemsl. (*G. C.* 1892, v. xi., p. 682.) Scitamineæ. S. A new species allied to *C. australasica,* Hk. f., with larger orange-coloured fl., and club-shaped tubers. New Guinea. (F. Sander & Co.)

***Cusparia undulata,** Hemsl. (*G. C.* 1892, v. xii., p. 396.) Rutaceæ. S. A new species which forms a shrub or small tree with unbranched stems and palmate leaves not unlike an *Aralia.* Fl. white, in axillary racemes. Brazil. (Kew.)

***Cyclamen alpinum,** Damm. (*Gfl.* 1892, p. 526.) Primulaceæ. H. alpine plant. A very dwarf form, with small l., marked with white, and purple-red fl., with a blackish eye. There is also a white variety. Asia Minor. (Dammann & Co.)

Cyclamen tauricum, Damm. (*Dammann Cat.* 1892, p. 4.) H. A form with large l., often marked with silvery-grey, and pure white fl. Taurus. (Dammann & Co.)

N.B.—Probably both *C. alpinum* and *C. tauricum* are forms of *C. europæum* from high elevations.

Cyclanthus godseffianus, Hort. Sander. (*G. C.* 1892, v. xi., p. 731.) Cyclanthaceæ. S. Name only. (F. Sander & Co.)

Cymbidium Humblotii, Rolfe. (*G. C.* 1892, v. xii., p. 8.) Orchideæ. S. A new species with the foliage and habit of *C. giganteum,* and a branching panicle of numerous green and black fl., recalling *Cœlogyne pandurata.* Madagascar. (C. Ingram.)

Cymbidium lowianum, Rchb. f. var. **viride,** Hort. Lewis. (*G. C.* 1892, v. xi., p. 698.) S. A variety with greenish-yellow fl. devoid of purple on the lip. (Lewis & Co.)

Cymbidium winnianum. (*G. C.* 1892, v. xii., p. 566.) G. A garden hybrid between *C. giganteum* and *C. eburneum.* (F. Sander & Co.)

Cypripedium Adrastus. (*G. C.* 1892, v. xi., p. 343.) Orchideæ. S. A garden hybrid between *C. Boxalli* and *C. leeanum.* (J. Veitch & Sons.)

Cypripedium albertianum. (*G. C.* 1892, v. xii., p. 672.) S. A garden hybrid between *C. spicerianum* and *C. insigne,* var. *Wallacei.*

Cypripedium Arète. (*G. C.* 1892, v. xii., p. 744.) S. A garden hybrid between *C. concolor* and *C. spicerianum.*

Cypripedium Baconis. (*G. C.* 1892, v. xi., p. 171.) S. A garden hybrid between *C. chlorops* and *C. Schlimii.* (Sander & Co.)

Cypripedium Bijou. (*G. C.* 1892, v. xii., p. 138.) S. A garden hybrid between *C. œnanthum* and *C. lawrenceanum.*

Cypripedium bosscherianum. (*G. C.* 1892, xi., p. 11.) A mistake for **C. debosscherianum.**

Cypripedium Bryani. (*G. C.* 1892, v. xii., p. 138.) S. A garden hybrid between *C. Argus* and *C. philippinense.* (N. C. Cookson.)

Cypripedium Brysa. (*G. C.* 1892, v. xi., p. 343.) S. A garden hybrid between *C. Sedeni* and *C. boissierianum.* (J. Veitch & Sons.)

Cypripedium Calceolus × macranthos, Barbey. (*G. C.* 1892, v. xi., p. 394.) H. A supposed natural hybrid imported from the birch forests of Western Siberia.

***Cypripedium chamberlainianum,** O'Brien. (*G. C.* 1892, v. xi., p. 234, fig. 34.) S. A new species with the habit of *C. superbiens.* It has broad strap-shaped l., and scapes 2 ft. high, bearing large boat-shaped bracts and numerous fl. coloured rosy-purple and white; in form they are not unlike those of *C. spectabile.* New Guinea. (Sander & Co.)

Cypripedium chamberlainianum, O'Brien, var. **excellens,** Hort. Sander. (*G. C.* 1892, v. xi., p. 700.) S. A variety with a pale dorsal sepal. (Sander & Co.)

Cypripedium Chrysocomes. (*G. C.* 1892, v. xi., p. 781.) S. A garden hybrid between *C. caudatum,* var. *roseum,* and *C. conchiferum* × (R. H. Measures.)

Cypripedium Cleopatra. (*G. C.* 1892, v. xi., p. 458.) S. A garden hybrid between *C. Hookeræ* and *C. œnanthum superbum.* (C. Winn.)

Cypripedium cowleyanum. (*G. C.* 1892, v. xi., p. 72.) S. A garden hybrid between *C. Curtisii and C. niveum.* (F. G. Tautz.)

Cypripedium Daisyæ. (*G. C.* 1892, v. xii., p. 331; *G. and F.*, v. v., p. 460, fig. 79.) S. A garden hybrid between *C. Lowii* and *C. œnanthum superbum.* (H. Graves.)

Cypripedium debosscherianum. (*R. H. B.* 1892, p. 6.) S. A garden hybrid between *C. spicerianum* and *C. barbatum,* var. *superbum.* (Vuylsteke.)

Cypripedium decorum. (*R. H. B* 1892, p. 6.) S. A hybrid between *C. Sallieri,* var. *hyeanum,* and *C. lawrenceanum.* (Hye-Leysen.)

Cypripedium Edithæ. (*G. C.* 1892, v. xii., p. 458.) S. A garden hybrid between *C. conchiferum* and *C. Schlimii.* (F. Sander & Co.)

Cypripedium Edith Winn. (*G. C.* 1892, v. xii., p. 138.) S. A garden hybrid between *C. Stonei* and *C. purpuratum.* (C. Winn.)

Cypripedium Ensign. (*G. C.* 1892, v. xi., p. 73.) S. A garden hybrid between *C. harrisianum* and *C. barbatum.* (C. Winn.)

Cypripedium Eurylochus. (*G. C.* 1892, v. xi., p. 664.) S. A garden hybrid between *C. ciliolare* and *C. hirsutissimum.* (Veitch & Sons.)

Cypripedium Evenor. (*G. C.* 1892, v. xi., p. 664.) S. A garden hybrid between *C. Argus* and *C. bellatulum.* (J. Veitch & Sons.)

***Cypripedium Exul,** O'Brien. (*G. C.* 1892, v. xi., p. 522, fig. 77.) S. A new species which had been described as a variety of *C. insigne.* It is not unlike *C. Druryi,* but the fl. are coloured like those of *C. insigne.* Syn. *C. insigne* var. *Exul,* Ridley; *C. insigne* var. *siamense,* Hort. (F. Sander & Co., &c.)

Cypripedium Exul, O'Br. var. **imschootianum,** Rolfe. (*L.* v. 7, p. 81, p. 327.) S. A variety with a narrower white border to the dorsal sep. and narrower pet. with white tips. Siam. (L'Horticulture Internationale.)

Cypripedium festum. (*Gard.* 1892, v. xli., p. 26.) S. A garden hybrid between *C. barbatum* and *C. chloroneurum.* (Seeger & Tropp.)

Cypripedium Gigas. (*G. C.* 1892, v. xi., p. 136.) S. A garden hybrid between *C. lawrencianum* and *C. harrisianum.* (C. Ingram.)

Cypripedium Hecla. (*G. C.* 1892, v. xii., p. 138.) S. A garden hybrid between *C. superbiens* and *C. swanianum.* (C. Ingram.)

Cypripedium Ianthe. (*G. C.* 1892, v. xi., p. 343.) S. A garden hybrid between *C. harrisianum* and *C. venustum.* (J. Veitch & Sons.)

Cypripedium johnsonianum. (*G. C.* 1892, v. xii., p. 744.) S. A garden hybrid between *C. nitens magnificum* and *C. lawrencianum.* (F. Sander & Co.)

Cypripedium La France. (*Gard.* 1892, v. 41, p. 48; *O.* 1892, p. 2.) S. A garden hybrid between *C. niveum* and *C. nitens.* (Seeger & Tropp.)

Cypripedium lawrebellum. (*G. C.* 1892, v. xi., p. 502, and p. 560, fig. 82.) S. A garden hybrid between *C. lawrencianum* and *C. bellatulum.* (Sir T. Lawrence.)

Cypripedium Leda. (*G. C.* 1892, v. xi., p. 202.) S. A garden hybrid probably between *C. harrisianum* and *C. venustum.* (J. C. Bowring.)

Cypripedium Lucie. (*O.* 1892, p. 17, with pl.) S. A garden hybrid between *C. lawrenceanum* and *C. ciliolare.* (Moreau, Paris.)

Cypripedium Perseus. (*G. C.* 1892, v. xii., p. 622.) S. A garden hybrid between *C. Sedeni porphyreum* and *C. lindleyanum.* (J. Veitch & Sons.)

Cypripedium southgatense. (*G. C.* 1892, v. xi., p. 698; *J. of H.* 1892, v. xxv., p. 39, f. 6.) S. A garden hybrid between *C. bellatulum* and another. (Lewis & Co.)

Cypripedium Sphinx. (*O.* 1892, p. 130.) S. A garden hybrid between *C. Argus* and *C. Boxallii.* (Vuylsteke.)

Cypripedium Stonei, Hook. var. **candidum.** (*G. C.* 1892, v. xii., p. 75.) S. A variety with ivory-white flowers, the lip tinged with lilac and the petals with rose. (Pitcher & Manda.)

Cypripedium Swinburnei. (*G. C.* 1892, v. xi., p. 136.) S. A garden hybrid between *C. insigne* and *C. Argus.* (Heath & Son.)

Cypripedium Telemachus. (*G. C.* 1892, v. xi., p. 816.) S. A garden hybrid between *C. niveum* and *C. lawrencianum.* (J. Veitch & Sons.)

Cypripedium The Gem. (*G. C.* 1892, v. xii., p. 138.) S. A garden hybrid between *C. marmorophyllum* and *C. Chantini.* (C. Ingram.)

Cypripedium Tityus. (*J. of H.* 1892, v. xxv., p. 455, fig. 61.) S. A garden hybrid between *C. œnanthum superbum* and *C. spicerianum.* (J. Veitch & Sons.)

Cypripedium von molianum. (*G. C.* 1892, v. xi., p. 502.) S. A garden hybrid between *C. spicerianum* and *C. hirsutissimum.* (L'Horticulture Internationale.)

Cypripedium Warnero-superbiens. (*G. C.* 1892, v. xii., p. 301.) S. A garden hybrid between the two species indicated in the name. (H. Graves.)

Cypripedium youngianum, var. **superbum.** (*G. C.* 1892, v. xii., p. 138.) S. A garden hybrid between *C. philippinense* and *C. superbiens.* (N. C. Cookson.)

***Cyrtanthus Galpini,** Baker. (*Kew Bull.* 1892, p. 83.) Amaryllideæ. G. A new species allied to *C. sanguineus* with large bright red fl., which are developed before the l. in August. Transvaal. (Kew.)

Cyrtomium falcatum, Sw. var. **pendulum,** Veitch. (*Veitch Cat.* 1892, p. 8.) Filices. G. Differs from the type in its pendulous habit and narrower pinnæ. (J. Veitch & Sons.)

Cyrtosperma ferox, Lind. & Br. (*Ill. H.* v. 39, p. 59, pl. 153.) Aroideæ. S. A remarkable looking foliage plant with prickly petioles and scapes, arrow-shaped leaves, and greenish-white spathes. Borneo. (L'Horticulture Internationale.)

Cytisus schipkænsis, Dieck. (*Cat. Nat. Arb. Zösch.* 1892, p. 15.) Leguminosæ. H. shr. A dwarf species about a foot high with white fl. Balkan Mountains. (Zöschen Arboretum.)

Dendrobium Adrasta. (*G. C.* 1892, v. xi., p. 503.) Orchideæ. S. A garden hybrid between *D. Pierardii* and *D. superbum.* (J. Veitch & Sons.)

Dendrobium barbatulo - chlorops, Rolfe. (*G. C.* 1892, v. xi., p. 298.) S. A supposed natural hybrid between the two species indicated in the name. (Major-Gen. Berkeley.)

Dendrobium bigibbum, Lindl. var. **albomarginatum,** L. Lind. (*L.* v. 7, p. 61, pl. 317.) S. A variety with whitish edges to the fl. (L'Horticulture Internationale.)

Dendrobium burfordiense. (*G. C.* 1892, v. xii., p. 744.) A garden hybrid between *D. linawianum* and *D. aureum,* which are also the parents of *D. dulce.* (Sir T. Lawrence.)

Dendrobium chrysocephalum, Kränzlin. (*G. C.* 1892, v. xii., p. 122.) S. A new species with golden-yellow fl. very similar to *D. viride-roseum,* Rchb. f., but with a different lip. (Prince Liechtenstein.)

Dendrobium densiflorum, Wall. var. **clavatum,** Rolfe. (*G. C.* 1892, v. xi., p. 394.) S. A variety with clavate pseudobulbs and white and yellow fl. Shan States. (F. Sander & Co.)

Dendrobium dulce. (*G. C.* 1892, v. xi., p. 214.) S. A garden hybrid between *D. linawianum* and *D. aureum,* which are also the parents of *D. burfordiense.* (J. Veitch & Sons.)

Dendrobium euosmum leucopterum. (*G. C.* 1892, v. xi., p. 343.) S. A garden hybrid between *D. nobile* and *D. endocharis.* (J. Veitch & Sons.)

Dendrobium Euryclea. (*G. C.* 1892 v. xi., p. 503.) S. A garden hybrid between *D. lituiflorum* and *D. wardianum.* (J. Veitch & Sons.)

Dendrobium Nestor. (*G. C.* 1892, v. xi., p. 718.) S. A garden hybrid between *D. Parishii* and *D. superbum,* var. *anosmum.* (C. Winn.)

Dendrobium obrienianum, Kränzlin. (*G. C.* 1892, v. xi., p. 266.) S. A new species with small yellowish-green fl. Philippine Islands. (F. Sander & Co.)

Dendrobium Phalænopsis, Fitzg. var. **rothschildiana,** Kränzlin. (*G. C.* 1892, v. xii., p. 668. S. A variety with fl. 4 in. broad, snow-white, the lip light pink with darker lines on the disc. (Lord Rothschild.)

Dendrobium Rolfeæ. (*G. C.* 1892, v. xi., p. 522.) S. A garden hybrid between *D. primulinum* and *D. nobile.* (F. Sander & Co.)

Dendrobium striatum. (*G. C.* 1892, v. xii., p. 566.) S. A garden hybrid between *D. japonicum* and *D. dalhousieanum.* (J. Veitch & Sons.)

Dendrobium wardianum, var. **album,** Will (*W. O. A.* v. 10, pl. 450.) S. A white-flowered form with orange-yellow throat to the lip, and rathe slender stems. India. (W. R Lee Manchester.)

Dendrobium wardiano-japonicum (*G. C.* 1892, v. xi.. p. 343.) S. A garden hybrid between the two species indicated in the name. (J. Veitch & Sons.)

Dianthus brivatensis. (*Jard.* 1892, v. 6, p. 174.) Caryophylleæ. H. per. A garden hybrid between *D. superbus* and *D. barbatus.* (Blanchard.)

***Dianthus callizonus,** Scb. and Kotsch. (*B.M.* t. 7223.) H. perennial. The showiest of the dwarf alpine species. The plant is tufted, with pointed glaucous l. The fl. are large, 2 in. in diam., deep rosy-purple with a darker zone around the throat. June. Transylvania. (Kew.)

***Dianthus Freynii,** Vandas. (*G. C.* 1892, v. xi., p. 692.) H. perennial. A dwarf alpine species with linear glaucous l. and purple fl. ¾ in. in diam. May. Bosnia. (Kew.)

Dichorisandra angustifolia, Lind. & Rod. (*Ill. H.* v. 39, p. 81, pl. 158.) Commelinaceæ. S. foliage plant, with lanceolate acute l. 4–6 in. long, dark green marked with numerous transverse white streaks between the nerves, purple beneath. Ecuador. (L'Horticulture Internationale.)

Dichorisandra musaica, Koch. and Lind., var. **gigantea.** (*G. C.* 1892, v. xi., p. 696.) S. A variety with stems 2 ft. high, and l. 9 in. long by 5 in. broad. (L'Horticulture Internationale.)

Didymocarpus lacunosa, Hook. f. (*B. M.* t. 7236.) Gesneraceæ. S. A new species allied to *D. crinita,* Jack, from which it differs in habit, and colour of its fl. It is a lovely little plant with ovate cordate l. and a Streptocarpus-like inflorescence, the fl. are tubular, 1½ in. long, nodding, violet-blue. Penang. (J. Veitch & Sons.)

Dieffenbachia Meleagris, Lind. & Rod. (*Ill. H.* v. 39, p. 89, pl. 159.) Aroideæ. S. foliage plant. A slender species, with mottled petioles, and lanceolate acuminate, dark-green l., marked with a few white spots. Ecuador. (L'Horticulture Internationale.)

Dieffenbachia Olbia, Lind. & Rod. (*Ill. H.* v. 39, p. 31, pl. 148.) S. A fine foliage plant, with large oblong-lanceolate, dark-green l., feathered with white along the midrib, and spotted with yellow-green and white. Peru. (L'Horticulture Internationale.)

Dieffenbachia picturata, Lind. & Rod. (*Ill. H.* v. 39, p. 101, pl. 162.) S. foliage plant with ovate-oblong, acute l., of a dark green spotted with white. Venezuela. (L'Horticulture Internationale.)

Digitalis ciliata, Traut. (*G. C.* 1892, v. xii., p. 614.) Scrophularineæ. H. Nearly allied to *D. grandiflora,* but differing in its campanulate fl. and hairy calyx. June to September. Caucasus. (Correvon.)

Diosma Wendlandi, Carr. (*R. H.* 1892, p. 155.) Rutaceæ. G. A dwarf shrub with slender branches, closely beset with small, narrow l., and ending in heads of numerous white fl. South Africa. (Gentilhomme, Vincennes.)

Dipladenia atropurpurea, A. DC., var. **Clarkei,** Hort. Sander. (*G. C.* 1892, v. xi., p. 763.) Apocynaceæ. S. This is typical **D. atropurpurea,** as represented in *Bot. Reg.* 1843, t. 27. It has also been exhibited by Messrs. F. Sander & Co. as *D. Marie Henrietta.* (See *Kew Bull.* 1891, *App.* II., p. 42.)

***Disa Cooperi,** Rchb. f. (*G. C.* 1892, v. xii., p. 268, fig. 45; *B. M.* t. 7256.) Orchideæ. S. Apparently a free growing plant with lanceolate green l. 7 in. long, and erect scapes 1 ft. high, the lower part clothed with leafy bracts, the upper with fragrant long-spurred fl. of a rosy-carmine with yellow lip. S. Africa. (F. Sander & Co.)

***Disa incarnata,** Ldl. (*G. C.* 1892, v. xi., pp. 343, 618, fig. 88; *B. M.* t. 7243.) S. A pretty plant with lanceolate l., spotted with red at the base; scape a foot high, bearing numerous orange-red fl., nearly an inch across. Madagascar. (W.-L. Lewis & Co.)

Dracæna Coullingii. (*Gard.* v. xii., p. 430.) Liliaceæ. S. "A hybrid between *D. mooreana* and *D. terminalis* "*alba,* the leaves narrower but longer "than those of the latter, and variegated green and white. Probably a "*Cordyline.*" (J. Veitch & Sons.)

Dracæna sanderiana, Hort. Sander. (*G. C.* 1892, v. xi., p. 731.) S. "Leaves narrow lanceolate, sheathing "at the base, green striped with white." (F. Sander & Co.)

Echeveria Fulini, Thomayer. (*R. H.* 1892, p. 362.) Crassulaceæ. G. succulent, suitable for summer bedding. A seedling variety of *Cotyledon metallica.* (Thomayer.)

Echidnopsis dammanniania, Damm. (*W. G.* 1892, p. 351, f. 59; *Gfl.* 1892, p. 526, f. 107; *Jard.* 1892, v. 6, p. 251, with fig.) Asclepiadeæ. G. or S. succulent. Very similar to *E. cereiformis,* but with brown fl. Abyssinia. (Dammann & Co.)

***Emmenanthe penduliflora,** S. Wats. (*G. C.* 1892, v. xi., p. 339, fig. 49.) Hydrophyllaceæ. A handsome hardy annual, 2 ft. high. L. deeply cut, and covered with sticky hairs. Fl. in loose panicles, bell-shaped, and of a cream or yellow colour. July. California. (Veitch & Sons, Exeter.)

Epidendrum capartianum, L. Lind. *See* **E. godseffianum.**

Epidendrum godseffianum, Rolfe. (*G. C.* 1892, xi., p. 136.) Orchideæ. S. A new species of the section *Encyclium,* with stout long bulbs and long branching racemes of brown, white, and rose-purple fl. Syn. *E. capartianum,* L. Lind. (*L.* v. 7, p. 93, pl. 333.) Brazil, S. (Sander & Co., L'Horticulture Internationale.)

Epidendrum mantinianum, Rolfe. (*Ill. H.* v. 39, p. 43, pl. 150.) S. A dwarf species with glaucous green l., and large solitary fl., pale whitish-green marked with purple-brown dots on the veins of the sep. and pet., and with larger markings on the acute lip. (L'Horticulture Internationale.)

Epidendrum Ortgiesi, Rgl. (*Gfl.* 1892, p. 139.) S. A showy species with 1 to 2 strap-shaped l., and a raceme of rather large fl. Sep. and pet. red with a white border, lip purple. (St. Petersburg Botanic Gardens, received from Sander & Co. as *E. amabile.*)

***Epidendrum watsonianum,** Sander. (*G. C.* 1892, v. xi., p. 214.) S. A new species, allied to *E. godseffianum.* Brazil, S. (Sander & Co.)

Eria laucheana, Kränzlin. (*G. C.* 1892, v. xi., p. 809.) Orchideæ. S. A new species near *E. dillwyniana,* Hook. It has a drooping raceme of green and purple fl. (Prince Liechtenstein.)

Eria vestita, Ldl. (*G. C.* 1892, v. xii., p. 138.) S. A tall-growing plant with lanceolate fleshy l., and long pendent racemes of white fl., the whole plant clothed with bright red-brown hairs. (? = *E. velutina,* Ldl.) (C. J. Lucas.)

***Eritrichium nothofulvum,** A. Gr. (*W. G.* 1892, p. 439, f. 70.) Boragineæ. H. annual; in general appearance very like a Forget-me-not, with sweet scented white fl. California. (Hillebrand & Bredemeier, Palanza.)

Eucharis Clibrani. *See* **Urceocharis Clibrani.**

***Eulophia Mackenii,** Rolfe. (*G. C.* 1892, v. xii., p. 583.) Orchideæ. S. A new species closely resembling *E. maculata*, Rchb. f., but with broader leaves and flower segments. Natal. (Kew.)

Eulophiella Elizabethæ, Lind. and Rolfe. (*L.* v. 3, p. 77, pl. 325; *Journ. O.* v. 3, p. 96, f. 11, and p. 101.) Orchideæ. S. This is a fine large *Eulophia* with white fl. having a yellow lip, and the back of the sep., scape, and ovaries dull purple. (L'Horticulture Internationale.)

Fagus sylvatica, L. var. **fol. striatis,** Bosc. (*G. C.* 1892, v. xii., p. 669.) Cupuliferæ. H. "Discovered . . . "in a forest in Hessia. Soon after "opening the l. show a regular golden "striation, parallel with the nerves, and "this striking appearance lasts till the "l. fall off." (Zöschen Arboretum.)

Fagus sylvatica Zlatia, Späth. (*G. C.* 1892, v. xii., p. 669.) H. A form having golden - tinted l. Servia. (Späth.)

***Fraxinus raibocarpa,** Rgl. (*W. G.* 1892, p. 211, f. 36.) Oleaceæ. H. tree of graceful habit, the l. with but few, and rather small leaflets, and the fr. sickle-shaped. Central Asia. (Zöschen Arboretum.)

***Gentiana oregana,** Engelm. (*Gard.* 1892, v. xlii., p. 214.) Gentianeæ. H. A stout erect species, 1–2 ft., l. ovate-oblong. Corolla broadly funnel-shaped, bright blue, allied to *G. affinis*. September. N. America. (Kew.)

***Gladiolus armeniacus.** (*G. and F.* 1892, v., p. 318.) Irideæ. H. A handsome dwarf species with numerous small deep purplish fl. July. Armenia. (Max Leichtlin; Kew.)

***Gladiolus oppositiflorus,** Herb. (*G. C.* 1892, v. xii., p. 552.) H. H. An interesting plant supposed to be one of the parents of the present popular race of garden gladioli (Gandavensis section). It was in cultivation 50 years ago, and supposed to be from Madagascar. It has lately been found in the Transkei, S. Africa, and sent to Kew, where it flowered in October last. Its spikes are 6 ft. high, and the fl. white with purple lines.

Gloxinia × Tapeinotes. (*W. G.* 1892, p. 305, t. 3.) Gesneraceæ. S. A hybrid between *Tapeinotes Carolinæ* and some spotted *Gloxinia*. (Hübsch.)

***Gynura sarmentosa,** D.C. (*B. M.* t. 7244.) Compositæ. S. A loose growing succulent herb with lanceolate l., reddish stems, branched above and bearing numerous heads of dull orange fl. Malaya. (Kew.)

Gypsophila raddeana, Rgl. (*Gfl.* 1892, p. 90, t. 1365, f. 5–8.) Caryophylleæ. H. perennial rockwork plant, of dwarf tufted habit, with small green l. and pale pink fl. Persia. (St. Petersburg Botanic Garden.)

***Habenaria longicalcarata,** A. Rich. (*B. M.* t. 7228.) Orchideæ. G. A tall species with plantain-like radical l., erect scapes, bearing a few fl., which are 1½ in. in diam., white, with a pendent spur 4 or 5 in. long. Western Ghats of India. (Sir M. Grant Duff.)

***Halesia tetraptera,** L. var. **Meehani.** (*G. and F.* 1892, v. v., p. 534, fig. 91.) Styraceæ. H. A seedling variety of *H. tetraptera*, differing from the type in its distinctly rugose, thicker, pale l. and shorter-stalked, smaller-sized fl. (Meehan.)

Heliconia spectabilis, Lind. and Rod. (*Ill. H.* v. 39, p. 71, pl. 156.) Scitamineæ. S. per. This has green l. with a red midrib, and dull purple beneath. Tropical Asia. (L'Horticulture Internationale.)

Huernia macrocarpa, Damm. (*W. G.* 1892, p. 350, f. 58; *Gfl.* 1892, p. 526, f. 108.) Asclepiadeæ. A synonym of **H. Penzigii.**

***Huernia Penzigii,** N. E. Br. (*G. C.* 1892, xi., p. 719.) G. or S. succulent. A new species with stems 3 in. high, five-angled, with teeth nearly ⅛ in. long. Fl. in sessile cymes, 1 in. wide, campanulate black-purple. Syn. *H. macrocarpa*, Damm. Abyssinia. (T. Hanbury.)

***Hydnophytum Forbesii,** Hook. f. (*B. M.* t. 7218.) Rubiaceæ. S. A new species closely allied to *H. formicarium*, but the swollen part of the stem is echinate. Fl. long, tubular, white: fr. red, egg-shaped. New Guinea. (Kew.)

Impatiens Micholitzi, Hort. (*W. G.* 1892, p. 342.) Geraniaceæ. S. A dwarf bushy species with white or rosy fl. having a deep rose-coloured eye. New Guinea.

Ipomœa Bronsoni. (*G. and F.* 1892, v. v., p. 345.) Convolvulaceæ. "A "rapid grower with white stems, gouty "at the base. Fl. not seen." Cuba. (Thorburn & Co.)

***Iris asiatica,** Stapf. (*Gard.* 1892, xli., p. 121, fig.) Irideæ. H. per. An undescribed plant, but probably a variety of *I. pallida*. (Van Tubergen.)

Iris Madonna, Spr. (*B. T. O.* 1892, p. 130.) H. H. An evergreen species, with large lilac-blue fl. Arabia. (Dammann & Co.)

Iris maricoides, var. **purpurea,** Spr. (*B. T. O.* 1892, p. 129.) H. H. A garden variety with large purple fl. Syria. (Dammann & Co.)

***Iris nepalensis,** D. Don, var. **Letha,** Foster. (*G. C.* 1892, v. xii., p. 458.) A very distinct and new variety of *I. nepalensis*, differing in its sessile and very fragrant flowers. Summer. Upper Burmah. (M. Foster.)

Iris parabid. (*Gard.* 1892, v. xli., p. 459.) An interesting hybrid raised by Prof. Foster, between *I. iberica* and *I. paradoxa*. May. (M. Foster.)

***Ixiolirion macranthum,** Hort. (*W. G.* 1892, p. 346.) Amaryllideæ. H. or G. bulb. A fine form with deep blue fl. shaded with purple. (Max Leichtlin.)

Ixiolirion Sintenisi, Hort. (*W. G.* 1892, p. 346.) H. or G. A species with blue fl. lighter than those of *I. macranthum*. (Max Leichtlin.)

Ixora salmonea, Bull. (*Bull Cat.* 1892, p. 3.) Rubiaceæ. S. A garden variety with salmon and buff fl. (W. Bull.)

***Kalanchoe marmorata,** Baker. (*G. C.* 1892, v. xii., p. 300.) Crassulaceæ. G. A new species allied to *K. schimperiana*, Rich. It is perennial, with leafy stems, obovate cuneate l. 4 in. long, green blotched with brown. Cymes few flowered, corolla tube 2 in. long, limb 2 in. wide, white. Abyssinia. (T. Hanbury.)

Kniphofia Nelsoni, Mast. (*G. C.* 1892, v. xi., p. 554, fig. 83.) Liliaceæ. G. or H.? A distinct species resembling *K. triangularis*. L. spreading 1½ feet long, 3-nerved. Scape 2 ft. high, slender. Fl. densely crowded, brilliant orange-scarlet. Orange Free State. (Nelson.)

***Kniphofia pauciflora,** Baker. (*B. M.* t. 7269; *G. C.* 1889, v. ii., p. 65, f. 10.) A doubtful hardy species distinguished from most of the genus by its slender habit, narrow l., lax racemes, and pale yellow fl. March to July. Natal. (Kew.)

Labisia smaragdina, Lind. and Rod. (*Ill. H.* v. 39, p. 91, pl. 160.) Myrsineæ. S. An attractive species, almost stemless, with a rosette of oblanceolate, obtuse, bright green l., and panicles of pretty pink fl. Borneo. (L'Horticulture Internationale.)

Lælia anceps, Ldl. var. **oweniana.** (*G. C.* 1892, v. xii., p. 744; *J. of H.* 1892, v. xxv., p. 569, fig. 77.) Orchideæ. G. A large richly coloured variety, the fl. being flaked with white. (G. D. Owen.)

Lælia elegans, Rchb. f. var. **excellens.** (*G. C.* 1892, v. xii., p. 566.) G. A variety coloured like that known as *Turneri*, but with the folded portion of the lip pure white. (T. Statter.)

Lælia Latona. (*G. C.* 1892, v. xi., p. 598.) G. A garden hybrid between *L. cinnabarina* and *L. purpurata*. (J. Veitch & Sons.)

Lælia oweniana. (*G. C.* 1892, v. xii., p. 191.) G. A garden hybrid between *L. pumila*, var. *dayana*, and *L. xanthina*. (F. Sander & Co.)

Lælia purpurata, Ldl. var. **handleyana.** (*G. C.* 1892, v. xi., p. 700.) S. A dark coloured variety. (J. Cypher & Son.)

Lælio-Cattleya Ingramii. (*J. of H.* 1892, v. xxv., p. 141, fig. 20.) Orchideæ. S. A garden hybrid between *Lælia pumila dayana* and *Cattleya aurea*. (C. N. L. Ingram.)

Lælio-Cattleya Phœbe. (*G. C.* 1892, v. xi., p. 598.) G. A garden hybrid between *Lælia cinnabarina* and *Cattleya Mossiæ*. (N. C. Cookson.)

Lælio-Cattleya marriottiana. (*G. C.* 1892, v. xi., p. 503.) G. A garden hybrid between *Lælia flava* and *Cattleya Skinneri*. (Sir W. Marriott.)

Lagenaria virginalis, Damm. (*G. C.* 1892, v. xi., p. 85, fig. 16.) Cucurbitaceæ. S. A variety of the Bottle Gourd. **(L. vulgaris)** with waxy white fr. (Dammann & Co.)

Leopoldinia laucheana. (*G. C.* 1892, v. xi., p. 731.) Palmæ. S. Name only. (F. Sander & Co.)

Leptotes bicolor, Ldl. var. **brevis,** Rolfe. (*G. C.* 1892, v. xi., p. 42.) Orchideæ. G. A variety of **Tetramicra bicolor,** Bth., differing from the type in having shorter segments and a white lip. (B. S. Williams & Son.)

Lilium primulinum, Baker. (*B. M.* t. 7227.) Liliaceæ. G. or H.H. A new species allied to *L. nepalense*, which it resembles in growth and foliage, but the fl. are pale yellow tinged with green outside, and are produced in a terminal umbel. Upper Burmah. (H. Low & Co.)

***Lilium sulphureum,** Baker. (*B. M.* t. 7257.) G. or H. H. This is the correct name for the plant cultivated under the names of *L. wallichianum*, var. *superbum*. (*Kew Bull.* 1890, App. II., p. 49), and *L. ochroleucum*.

Lissochilus Græfei, Kränzlin. (*G. C.* 1892, v. xi., p. 749.) Orchideæ. S. A new species in the way of *L. Krebsii*. It has lanceolate plicate l. and a scape 4 ft. high, bearing about 20 fl. coloured green, brown, and yellow. (Dr. H. Græfe, Berlin.)

Lonicera syringantha, Maxim. (*Gfl.* 1892, p. 564, f. 115–116.) Caprifoliaceæ. H. shr. with pairs of small oblong obtuse l., and axillary pale pink fl. about ½ in. long. North China. (St. Petersburg Botanic Garden.)

Lycopodium mooreanum, Baker. (*G. C.* 1892, v. xii., p. 582.) Lycopodiaceæ. S. A new species allied to *L. reflexum*, with stems a foot long, erect, forked, l. crowded, short, pale green. Sporangia in the axils of the l. Brazil. (F. Sander & Co.)

Maranta sanderiana, Hort. Sander. (*G. C.* 1892, v. xi., p. 731.) Scitamineæ. S. An ornamental foliage plant in the way of *M. rosea-lineata*, but with much larger l. (F. Sander & Co.)

***Marica occidentalis,** Baker. (*G. C.* 1892, v. xii., p. 150.) Irideæ. S. A new species resembling *M. northiana*, but the fl. is not so large and the l. are shorter. Peru. (Kew.)

Masdevallia Cassiope. (*G. C.* 1892, v. xi., p. 749.) Orchideæ. G. A garden hybrid between *M. triangularis* and *M. harryana*. (Capt. Hincks.)

Masdevallia caudata × Estradæ. (*G. C.* 1892, v. xi., p. 664.) G. A garden hybrid between the two species indicated in the name. (F. Wigan.)

Masdevallia falcata. (*G. C.* 1892, v. xi., p. 764.) G. A garden hybrid between *M. Lindeni* and *M. veitchiana*.

Masdevallia harryana, var. **Gravesiæ,** Hort. (*G. C.* 1892, v. xii., p. 122, fig. 21.) G. A variety with pure white fl. (H. Graves, New Jersey.)

Masdevallia McVitiæ. (*G. C.* 1892, v. xii., p. 744.) G. A garden hybrid between *M. tovarensis* and *M. Veitchii*. (W. Thompson.)

Masdevallia shuttryana. (*G. C.* 1892, v. xi., p. 764.) G. A garden hybrid between *M. caudata* (*Shuttleworthii*) and *M. harryana*. (Sir F. Lawrence.)

***Microstylis Scottii,** Hook f. (*B. M.* t. 7268.) Orchideæ. S. A dwarf species with fleshy green stems. L. deciduous lanceolate, 5 in. long, wavy, brown with a green marginal band. Scapes erect, 6 in. long, bearing numerous small green and purple fl. Malaya. (Kew.)

Miltonia Clowesii gigantea, O'Brien. (*G. C.* 1892, xii., p. 552.) Orchideæ. S. A variety with shorter scapes and larger fl. than the type. (Major Mason.)

Mimosa Spegazinii, Pirotta. (*B. T. O.* 1892, p. 163.) Leguminosæ. G. shr. A new sensitive plant, armed with prickles at the base of the l., which have but one pair of pinnæ, bearing numerous leaflets. Fl. in globose heads in terminal racemes, with pale violet stamens. Pods 3–4 seeded, prickly. Argentine. (Botanic Garden, Rome.)

***Monodora grandiflora,** Benth. (*B.M.* t. 7260.) Anonaceæ. S. Although this is a well-known plant in botanical gardens, it has not been known to flower under cultivation till last year, when it bloomed in the palm house at Kew.

Mormodes buccinator, Ldl. var. **aurantiacum,** Rolfe. (*Ill. H.* v. 39, p. 11, pl. 144.) Orchideæ. S. A variety with orange sep. and pet. and a yellow lip. Peru. (L'Horticulture Internationale.)

Musa Martini, André. (*R. H. B.* 1892, p. 107, f. 12.) Scitamineæ. S. A form with reddish petioles and nerves, and the upper side of the l. glaucous green, underside clear green. Fl. bright rose. Introduced into France from Teneriffe.

***Nemesia strumosa,** Benth. (*G. C.* 1892, v. xii., p. 269, fig. 48; *B. M.* t. 7272.) Scrophularineæ. A charming hardy annual, 1–2 feet high, covered with glandular hairs. L. lanceolate toothed, fl. in corymbs, ¾–1 in. diam., very variable in colour, being white, ochreous, pale yellow, orange, scarlet, carmine, or rosy-purple, &c. August. Cape. (Sutton & Sons.)

Nephrolepis davallioides, Kze. var. **multiceps.** (*G. C.* 1892, v. xii., p. 249.) Filices. S. A variety with crusted pinnæ. (H. B. May.)

***Nicotiana tomentosa,** R.& P. (*B.M.* t. 7252.) Solanaceæ. G. The corrected name for the plant known as *N. colossea.* Brazil.

***Nymphæa Laydekeri rosea.** (*G.* and *F.* v. v., p. 280.) Nymphæaceæ. H.? Said to be a garden hybrid. It has small l., green above, reddish below, and rosy-pink fl., twice as large as those of *N. pigmæa.* (Marliac.)

Odontoglossum andersonianum, Rchb. f. var. **pulcherrimum,** O'Brien. (*G. C.* 1892, v. xi., p. 586.) Orchideæ. G. A very fine variety, with long curling segments, pale yellow, with brown-red blotches. (R. B. White.)

Odontoglossum Bleui, God. Leb. var. **splendidissimum.** (*G. C.* 1892, v. xi. p. 698.) G. Another name for **Miltonia Bleui,** God. Leb. (*Kew Bull.* App. II. 1890, p. 50.)

Odontoglossum crispum, Lindl. var. **nobilius.** (*J. of H.* 1892, v. xxiv., p. 220, fig. 34.) G. An exceptionally large-flowered variety with broad segments, each marked with large confluent blotches of reddish-brown on a white ground. (Baron Schröder.)

Odontoglossum crispum, Lindl. var. **Rex.** (*Gard.* v. xli., p. 546.) G. One of the finest varieties, the fl. being very large, with broad rose-tinted segments heavily blotched with chestnut. (Baron Schröder.)

Odontoglossum crispum, Lindl. var. **Sanderæ.** (*G. C.* 1892, v. xi., p. 698; *J. of H.* 1892, v. xxiv., p. 441, fig. 76.) G. A variety with large, crisped, heavily spotted fl. (F. Sander & Co.)

Odontoglossum crispum, Lindl. var. **xanthotes,** Hort. (*L.* v. 7, p. 51, pl. 312.) G. A variety with white fl. spotted with yellow. Columbia. (Baron Schröder.)

Odontoglossum owenianum, Rolfe. (*G. C.* 1892, v. xi., p. 535; and v. xii., p. 178.) G. A new species with white fl. tinged with yellow and blotched with brown, lip pure white. Colombia. (F. Sander & Co.)

Odontoglossum Pescatorei, Linden, var. **Lindeniæ,** Hort. (*L.* v. 7, p. 85, pl. 329.) G. A form with one large purple blotch on the disc of each sep. and pet. (L'Horticulture Internationale.)

Odontoglossum platycheilum, J. Weathers. (*G. C.* 1892, v. xi., p. 587, fig. 84; and v. xii., p. 35.) G. A new species with ovate monophyllous bulbs, semi-erect l., and a short scape bearing one or two fl. which are 2 in. across, creamy-white, the large lip coloured soft pink, with spots of purple. ? Cent. America. (R. J. Measures.)

Odontoglossum triumphans, Rchb. f. var. **aureum,** Will. (*W. O A.* v. 10, pl. 460.) G. A distinct variety with yellow fl., which are blotched with orange-yellow instead of brown. Columbia. (A. H. Smee.)

Odontoglossum wilckeanum, Rchb. f. var. **nobilior,** Hort. (*G. C.* 1892, v. xi., p. 700.) G. A variety with paler coloured fl. than the type. (Charlesworth & Co.)

Oncidium enderianum, Hort. Sander. (*G. C.* 1892, v. xii., p. 75.) Orchideæ. G. A supposed natural hybrid between *O. crispum* and *O. curtum.* (F. Sander & Co.)

***Oncidium gravesianum,** Rolfe. (*G. C.* 1892, v. xi., pp. 535, 650, fig. 94.) S. Very near, if not identical with, *O. prætextum.* It has branched panicles of yellow and brown fl. 2 in. in diameter. S. Brazil. (F. Sander & Co.)

Oncidium rolfeanum, Sander. (*G. C.* 1892, v. xii., p. 34.) G. A new species of the *Microchila* section and allied to *O. kienastianum,* with a long branching raceme of yellow and brown fl. Colombia. (F. Sander & Co.)

Oncidium saintlegerianum, Rolfe. (*G. C.* 1892, v. xii., pp. 582, 672.) G. A new species allied to *O. bifolium,* Sims., with oblong pseudobulbs, linear lanceolate l. 8 in. by 1 in.; scape 18 in. long, bearing several fl., which are yellow, with a large conspicuous crest coloured bright purple. S. Brazil. (F. Sander & Co.)

Onobrychis laconica, Orph. (*G. C.* 1892, v. xii., p. 615.) Leguminosæ. H. A very beautiful species, with large bright pink fl., and glaucous foliage. Summer. Servia. (Correvon.)

Oreopanax sanderianum, Hemsl. (*G. C.* 1892, v. xi., p. 718.) Araliaceæ. S. A new species, similar in habit to *Fatsia papyrifera.* L. mostly three-lobed, but variable in shape, leathery in texture, green. Fl. small in globose heads. Guatemala. (F. Sander & Co.)

***Pandanus dyerianus,** Hort. (*G. C.* 1892, v. xi., p. 731.) Pandaneæ. S. A variegated form of **P. inermis.** Also called *P. Baptistii.* (F. Sander & Co.)

Pandanus pacificus, Veitch. (*G. C.* 1892, v. xi., p. 664.) S. A distinct-looking plant with broad shining green l., the margins clothed with fine spines, and the apices narrowed abruptly to a long tail-like point. Pacific Islands. (J. Veitch & Sons.)

***Pasithea cærulea.** D. Don. (*B. M.* t. 7249.) Liliaceæ. G. An old plant introduced by Herr Max Leichtlin a few years ago, and flowered at Kew for the first time last year. It is allied to the Asphodels, and has grassy l., with long branched scapes of blue star-shaped fl. Chili. (Kew.)

Pelargonium multibracteatum, Damm. (*W. G.* 1892, p. 477, f. 78.) Geraniaceæ. G. An attractive species with trailing stems, deeply lobed l., of a bronzy-green marked with a dark zone, and numerous umbels of white fl. Abyssinia. (Dammann & Co.)

***Pelexia Travassosii,** Rolfe. (*G. C.* 1892, v. xi., p. 330.) Orchideæ. S. A new species with olive green l. spotted with white, and erect scapes, a foot high, of white fl. Brazil. (Kew.)

Pelexia wendlandiana, Kränzlin. (*G. C.* 1892, v. xi., p. 426.) S. A new species with a stem 2 ft. high, bearing a spike of greenish-brown fl. with a white lip. It is of no horticultural interest. (Herrenhausen.)

***Peperomia inquilina,** Hemsl. (*G. C.* 1892, v. xii., p. 428.) Piperaceæ. S. A small trailing species with red stems, and small fleshy, orbicular, green l. Central America. (W. Lees.)

Peperomia metallica, Lind. and Rod. (*Ill. H.* v. 39, p. 79, pl. 157.) S. herb, about a foot high, with alternate dark green l., with a pale greenish stripe along the midrib, and veined with reddish beneath. Peru. (L'Horticulture Internationale.)

Peristeria Lindeni, Rolfe. (*L.* v. 7, p. 83, pl. 328; *J. O.* v. 3, p. 97, f. 12, and p. 101.) Orchideæ. S. A distinct plant with broad plicate l. and short racemes of globose fl. The light ground colour is washed with dark purple, and thickly spotted with a darker purple. (L'Horticulture Internationale.)

Phaius hybridus. (*G. C.* 1892, v. xi., p. 519.) Orchideæ. S. A garden hybrid between *P. grandifolius* and *P. Wallichii.* Sir Joseph Hooker thinks these two are merely forms of one species. (D. O. Drewett.)

***Phaius sanderianus.** (*G. C.* 1892, v. xi., p. 598; *Gard.* v. xli., p. 430.) S. A seedling or hybrid of garden origin very like *P. Wallichii.* (F. Sander & Co.)

Phalænopsis Amphitrite. (*G. C.* 1892, v. xi., p. 618.) Orchideæ. S. A garden hybrid between *P. stuartiana* and *P. sanderiana.* (F. Sander & Co.)

Phalænopsis Artemis. (*G. C.* 1892, v. xii., p. 75.) S. A garden hybrid between *P. amabilis* and *P. rosea.* (J. Veitch & Sons.)

Phalænopsis schilleriana, var. **purpurea,** J. O'Brien. (*G. C.* 1892, v. xi., p. 105.) S. A variety with dark rosy-purple coloured fl. (Low & Co.)

Phyllocactus Franzii. (*Gfl.* 1892, p. 225, t. 1370, f. 1.) Cacteæ. S. A garden hybrid, origin not stated.

Phyllocactus Pommer Eschei. (*Gfl.* 1892, p. 225, t. 1370, f. 2.) S. A garden hybrid between *P. Wrayi* and *P. crenatus,* raised by Krause, Halle, Germany.

Pleurothallis teretifolia, Rolfe. (*G. C.* 1892, v. xii., p. 521.) Orchideæ. S. A new species allied to *P. teres,* Lindl., with narrow terete l. forming a tuft 9 in. high, and slender pendulous racemes of fleshy, brown fl. Brazil. (Charlesworth & Co.)

Podachænium andinum, André. (*R. H.* 1892, p. 414, f. 125–126.) Compositæ. S. A useful plant for subtropical bedding with large coarsely lobed l., and lax corymbs of fl.-heads with white rays and yellow disc. Andes, Columbia. (André.)

***Podocarpus pectinatus,** Pancher. (*G. C.* 1892, v. xi., pp. 113, 563, 662); Kew Bull. 1892, p. 105. Coniferæ. S. A species with silvery foliage recently introduced to Kew and St. Albans (Sander & Co.) through Mr. Moore, of the Sydney Botanic Gardens. It is a native of New Caledonia.

Polemonium cæruleum, L. var. **campanulatum,** Fr. (*G. C.* 1892, v. xii., p. 399.) Polemoniaceæ. H. herbaceous perennial, with pendent bell-shaped fl. of a bright lilac-blue, with golden stamens. L. pinnatifid, leaflets lanceolate. April, May. Northern Europe. (Correvon.)

Polygonum orientale, L. var **variegatum,** Carr. (*R. H.* 1892, p. 37, t. 8.) Polygonaceæ. H. An ornamental form with variegated leaves. Garden variety.

Primula calycantha, Leichtlin. (*W. G.* 1892, p. 237.) Primulaceæ. H. A new primrose with a rosette of smooth grey-green l., and many-flowered umbels of reddish-blue fl. Yunnan. (Max Leichtlin.)

Primula finmarchica, Jarg. (*G. C.* 1892, v. xii., p. 399.) A dwarf hardy perennial, nearly allied to *P. sibirica.* Fl. dark lilac. L. lanceolate. A useful species for rockeries. Summer. Lapland. (Correvon.)

Prunus præcox, Carr. (*R. H.* 1892, p. 488, t. 142, 143.) Rosaceæ. H. shrub. A garden seedling of *P. japonica,* var. *sphærica.*

Prunus Salzeri, Zdarek. (*G. C.* 1892, v. xii., p. 669.) Nearly related to *P. Padus;* fruit yellowish-white. Plant said to come true from seed. Carinthia and Styria. (Zöschen Arboretum.)

Pteris cristata, Hort. (*G. C.* 1892, v. xii., p. 249.) Filices. S. A sporeling from *P. Victoriæ Reginæ.* (H. B. May.)

Pteris Reginæ, Hort. (*G. C.* 1892, v. xii., p. 249.) S. A sporeling from *P. Victoria Reginæ.* (H. B. May.)

Pteris tremula variegata. (*G. C.* 1892, v. xii., p. 249.) S. A variety with variegated fronds. (H. B. May.)

***Ptychoraphis augusta,** Becc. (*G. C.* 1892, v. xii., p. 397, fig. 63.) Palmæ. S. An elegant little unarmed palm when young, with graceful pinnate foliage recalling *Cocos weddelliana.* It is a native of the Nicobar Islands, where it forms a slender tree 100 ft. high. (Kew.)

***Quercus macedonica,** A. DC. (*G. C.* 1892, v. xii., p. 669.) Cupuliferæ. H. "A magnificent oak of the *Cerris* group bearing large edible acorns." (Zöschen Arboretum; Kew.)

Quercus schochiana. (*Cat. Nat. Arb. Zösch.* 1892, p. 26.) H. tree. A hybrid between *Q. phellos* and *Q. palustris.* (Zöschen Arboretum.)

***Ranunculus carpathicus,** Herbich. (*B. M.* tab. 7266.) Ranunculaceæ. H. A distinct and showy perennial species, with creeping rootstock. Stem, 1 ft. high. L. nearly orbicular in outline, palmate, and crenate. Fl. 2 in. in diam., golden-yellow. May. Eastern Hungary. (Kew.)

Rhipsalis aculeata, Weber. (*R. H.* 1892, p. 428.) Cacteæ. S. succulent, with trailing cylindric stems that are slightly 8–10-angled and clothed with tufts of slender white spines. Fl. small whitish. Argentine Republic. (Jardin des Plantes, Paris.)

Rhipsalis anceps, Weber. (*R. H.* 1892, p. 427.) S. succulent. A species with long, narrow, flat or rarely triangular stems, crenulated on the margin, and having yellowish-white stems. Syn. *Lepismium anceps,* Weber. Brazil. (Jardin des Plantes, Paris.)

Rhipsalis capilliformis, Weber. (*R. H.* 1892, p. 425.) S. succulent. A dwarf, compact-growing species, with much branched stems, the branches short and very numerous, all pendent, and forming a tuft-like growth. Fl. lateral or subterminal, white. Brazil. (Jardin des Plantes, Paris.)

Rhipsalis clavata, Weber. (*R. H.* 1892, p. 429.) S. Something in the way of *R. salicornioides,* but with pendent stems and white fl. Syn. *Hariota clavata,* Hort. Brazil. (Jardin des Plantes, Paris.)

Rhipsalis comorensis, Weber. (*R. H.* 1892, p. 424.) S. succulent, with drooping, slender, cylindric stems of a yellowish-green, and whorls of short branches; fl. small, greenish-white. Comoro Isles. (Jardin des Plantes, Paris.)

Rhipsalis dissimilis, Schum. var. **setulosa,** Weber. (*R. H.* 1892, p. 428.) S. A variety with 5-angled stems. Syn. *R. setulosa,* Weber. Brazil. (Jardin des Plantes, Paris.)

Rhipsalis gibberula, Weber. (*R. H.* 1892, p. 426.) S. A slender species with jointed, dichotomous or whorled branches, and numerous white fl. on the sides of the branches, with the ovary immersed in the stem. Berries large, white. Brazil. (Jardin des Plantes, Paris.)

Rhipsalis gonocarpa, Weber. (*R. H.* 1892, p. 427.) S. Allied to *R. platycarpa,* with flat, crenulated stems, and white fl. about ½ in. in diam., with the ovary 4–5-winged. Syn. *R. pterocarpa,* Weber. Brazil. (Jardin des Plantes, Paris.)

Rhipsalis madagascariensis, Weber. (*R. H.* 1892, p. 424.) S. succulent, a much branched species, with trailing or drooping, 6–10-angled stems, about ¼ in. thick, with tufts of white hairs along the angles; fl. very numerous, greenish. Madagascar. (Jardin des Plantes, Paris.)

Rhipsalis salicornioides, Haw. var. **bambusoides,** Weber. (*R. H.* 1892, p. 429.) S. A very large form, growing to 6 ft. high, with rigid erect stems something like those of a Bamboo, and orange-yellow or reddish-orange fl. Brazil. (Jardin des Plantes, Paris.)

Rhipsalis suareziana, Weber. (*R. H.* 1892, p. 425.) S. A much-branched trailing or drooping species, with stems of two kinds, one long and slender, the other short and very numerous, not verticillate; the young stems fusiform or 4-5-angled. Fl. small lateral. Diego Suarez. (Jardin des Plantes, Paris.)

Rhipsalis tetragona, Wil. (*R. H.* 1892, p. 428.) S. A dwarf species with much-branched decumbent stems, tetragonal or sometimes cylindric. Possibly the same as *R. prismatica*, but less robust. (Jardin des Plantes, Paris.)

Rhipsalis tucumanensis, Weber. (*R. H.* 1892, p. 426.) G. or S. A large-growing species, with stout trailing stems similar to those of *R. funalis*, cylindric or angular. Fl. solitary, of moderate size, white tipped with rosy, the ovary immersed in the stem. Argentine Republic. (Jardin des Plantes, Paris.)

Rhipsalis virgata, Weber. (*R. H.* 1892, p. 425.) S. A species allied to *R. minutiflora*, with cylindric, much-branched, drooping stems, ¼ in. thick. Fl. small, white, solitary or in pairs along the branches. Brazil. (Jardin des Plantes, Paris.)

Rhipsalis warmingiana, Schum. (*Gfl.* 1892, p. 8, f. 5–7.) S. succulent. A species with flat or 3–4-angled stems, and white fl. about ¾ in. in diam. Brazil. (Lindberg, Stockholm.)

Rhipsalis zanzibarica, Weber. (*R. H.* 1892, p. 425.) S. Very similar to *R. Cassytha*, of which it is, perhaps, only a robust form. Zanzibar. (Jardin des Plantes, Paris.)

***Rhododendron Luscombei.** (*G. C.* 1892, v. xi., p. 780.) Ericaceæ. H. A garden hybrid between *R. Fortunei* and *R. Thomsoni*, raised by the late Mr. Luscombe 12 years ago. (Kew.)

***Rhododendron racemosum,** Hort. (*G. C.* 1892, v. xi., p. 535 : v. xii., p. 62, fig. 9; *G. and F.*, v. v., p. 222; *Gard.* v. xlii., p. 320, pl. 878.) H. The plant exhibited under this name does not agree with Franchet's description, nor with the specimen in the Kew herbarium. The former is a small Box-like shrub 6 in. high, with loose terminal heads of rose and white campanulate fl. nearly an inch across, and not unlike some of the forms of *R. parviflorum*. Yunnan. (J. Veitch & Sons.)

Richardia aurata. (*Gard.* v. xlii., p. 529.) Aroideæ. G. This is said to be a garden hybrid between *R. hastata* and *R. maculata*, and is described as having spotted l. and large yellow spathes similar to those of *R. elliottiana.* (J. B. A. Deleuil.)

Richardia elliottiana, Hort. (*G. C.* 1892, v. xii., p. 123.) G. A yellow spathed species with spotted leaves, raised from seeds obtained from Africa by Captain Elliott about six years ago. Syn. *Calla elliottiana*. This plant was exhibited and certified three years ago.

Richardia Pentlandi, Hort. (*G. C.* 1892, v. xi., p. 816.) G. Apparently a distinct species with the robustness of *R. africana* and large spathes of a rich yellow colour. S. Africa. (R. Whyte.)

Robinia neo-mexicana, Gray, var. **luxurians,** Dieck. (*G. C.* 1892, v. xii., p. 669.) Leguminosæ. H. "This beautiful form inhabits the Colorado Plateau and the Southern Rocky Mountains. The typical form has a dwarfish habit. This variety grows mostly higher and its racemes are mostly branched. In Zöschen it flowered twice a year, first in June, and then in August, on the youngest branchlets." (Zöschen Arroretum.)

Rodriguezia Lindeni, Cogn. (*J. O.*, v. 3, p. 10, f. 1.) Orchideæ. S. This is a synonym of **R. pubescens,** Rchb. (L'Horticulture Internationale.)

Rosa glutinosa, Sieb. & Sm., var. **yarmalensis.** (*G. C.* 1892, v. xii., p. 669.) Rosaceæ. H. "A very neat, small-leaved variety, from the mountains of Smyrna, where at a height of 1,950 to 2,294 ft. it grows in very rich soil. This shrub, not much higher than 2½ ft., is characterised by its strong uncinate spines, very similar to those of *R. Serafini*. Its comparatively large fl. are of a whitish-red colour. A valuable acquisition for the rock garden." (Zöschen Arboretum.)

Rubus cæsius L. var. **turkestanica,** Rgl. (*Gfl.* 1892, p. 106, f. 25.) Rosaceæ. H. Bramble with small and very narrow petals, and elongate berries of good flavour. Turkestan. (St. Petersburg Botanic Garden.)

Rubus Miltspanghi, Bailey. (*W. G.* 1892, p. 216.) H. A spineless bramble with edible fruit. N. America.

Rubus xanthocarpus, Bur & Franch. (*Gfl.* 1892, p. 108.) H. Bramble of dwarf habit 8–15 in. high, with white fl., solitary or in pairs in the axils of the upper l., succeeded by yellow fr. Syn. *R. Potanini.* North China. (St. Petersburg Botanic Garden.)

Sarchochilus borneensis, Rolfe. (*Ill. H.* v. 39, p. 99, pl. 161.) Orchideæ. S. A distinct-looking species of erect habit, with long peduncles bearing a short spike of yellowish fl., with narrow spreading sep. and pet. about 1½ in. long, and a spotted lip. Borneo. (L'Horticulture Internationale.)

Scabiosa correvoniana, Somnier. (*G. C.* 1892, xii., p. 614.) Dipsaceæ. H. A handsome bushy species with erect stems 7–9 in. high, bearing large heads of pale yellow fl. May, August. Abchasia. (Correvon.)

***Schizocodon soldanelloides,** S. & Z. (*Gard.* 1892, v. xli., p 314.) Diapensiaceæ. H. alpine 2–4 in. high, l. small, evergreen, ovate, toothed, fl. fringed like those of *Soldanella*, deep rose in centre, shading to bluish-white. April. Japan. (Capt. Torrens.)

Scilla bipartita, Salz. (*Gfl.* 1892, p. 609.) Liliaceæ. G. bulb. A dwarf winter flowering species with spikes of porcelain-blue fl. Morocco. (Dammann & Co.)

Sempervivum Thomeyeri. (*W. G.* 1892, p. 117.) Crassulaceæ. H. A garden hybrid between *S. hirtum* and *S. arachnoideum*, raised by Mr. Thomeyer, of Prague. (Correvon.)

***Senecio Galpini,** Hook. f. (*B. M.* t. 7239; *J. of H.* 1892, p. 3.) Compositæ. A new species of the section *Kleinia.* It forms a compact tuft of short barren stems and fleshy glaucous oblanceolate l. Flower-stem leafy, a ft. high, ending in a lax corymb of brilliant orange fl. Transvaal. (Kew.)

***Senecio sagittifolius,** Baker. (*R. H.* 1892, p. 53, f. 16–17.) G. A grand species growing 7–10 ft. high, with a rosette of sagittate l. a yard long, crested along the midrib, and a large terminal panicle of flower-heads each 1½ in. in diam., with a white ray and yellow disc. Uruguay. (André.)

Smilax argyrea, Lind. and Rod. (*Ill. H.* v. 39, p. 51, pl. 152.) Liliaceæ. S. An ornamental climber with prickly stems and lanceolate acuminate l., handsomely variegated with white spots. Bolivia. (L'Horticulture Internationale.)

Sobolewskya clavata, Boiss. (*Gard.* 1892, v. xli., p. 484.) Cruciferæ. A graceful hardy herbaceous perennial, bearing numerous corymbs of pure white fl. May. Armenia. (Max Leichtlin.)

Sobralia beyeriana, Hort. (*Gard.* v. xlii., p. 324.) Orchideæ. G. A dwarf plant, 18 in. high, with broad l., and fl. 5 in. across, white tinged with pink; lip, large, wavy, rosy-lilac with a yellow throat. (Seeger & Tropp.)

Sobralia lucasiana, Hort. (*G. C.* 1892, v. xi., p. 816.) G. Probably a variety of *S. macrantha.* It has large fl. with white and lilac segments, the lip rosy-lilac with a yellow blotch at the base. Hab.? (C. J. Lucas.)

Solanum coronatum, Vel? (*W. G.* 1892, p. 30.) Solanaceæ. G. or H. H. A much-branched leafy species growing about a yard high, with dark green pinnatifid l., and armed with violet and grey prickles. Fruit as large as a plum, variegated. (Dammann & Co.)

Solanum dublosummatum, Damm. (*W. G.* 1892, p. 477, f. 79.) S. A fine, tall-growing plant suitable for subtropical bedding, with large pinnatifid l. of a clear green, suffused with bronzy and armed with yellow prickles; fl. large, blue; fr. white. Abyssinia. (Dammann & Co.)

Sophrocattleya Veitchii. (*G. C.* 1892, v. xii., p. 312.) Orchideæ. G. A garden hybrid between *Lælio-Cattleya elegans* and *Sophronitis grandiflora.* (J. Veitch & Sons.)

Spathoglottis Veillardii, Rchb. f. var. **rubra,** Hort. (*G. C.* 1892, v. xii., p. 566, *J. of H.* 1892, v. xxv., p. 529, fig. 70.) Orchideæ. S. A variety with larger and darker coloured fl. than the type. (Sir T. Lawrence.)

Stanhopea moliana, Rolfe. (*L.* v. 7, p. 89, pl. 331.) Orchideæ. S. Allied to *S. Ruckeri* and *S. Wardi.* The sep. are yellowish-white and the pet. white, all marked with annular rose-coloured spots; lip white, dotted with purple. Peru. (L'Horticulture Internationale.)

Stauropsis warocqueana, Rolfe. (*L.* v. 7, p. 65, pl. 319.) Orchideæ. S. A beautiful species with rich racemes of moderate-sized fl. Sep. and pet. yellow dotted with pale red-brown; lip white, spotted with rosy. New Guinea. (L'Horticulture Internationale.)

Stenandrium beeckmanianum. (*Ill. H.* v. 39, p. 121, t. 166.) Acanthaceæ. S. A garden hybrid between *S. pictum* and *S. Lindeni.* (L'Horticulture Internationale.)

***Synandrospadix vermitoxicus,** Engler. (*B. M.* t. 7242.) Aroideæ. S. Rootstock tuberous with annual l., which are large, hastate, green, and very succulent; scape 1 ft. high, bearing an ovate open spathe 6 in. long and 4 in. wide, grey-green outside, flesh-coloured inside; spadix as long as the spathe, covered with fl. Tucuman. (Kew.)

Tacsonia smythiana. (*G. C.* 1892, xii., pp. 442, 704, fig. 109.) Passifloreæ. S. A garden hybrid or seedling very similar to *T. mollissima*, but with brighter coloured fl. (W. Nicholson.)

Talinum roseum, Damm. (*Dammann Cat.* 1892, p. 4.) Portulaceæ. G. A dwarf succulent shrub with long panicles of rose-coloured fl. Abyssinia. (Dammann & Co.) Perhaps the same as *T. cuneifolium*, Willd.

Tchihatchewia isatidea, Boiss. (*Gard.* 1892, v. xli., p. 484.) Cruciferæ. H. A handsome perennial rock plant, forming rosettes like *Saxifraga longifolia*, and racemes of bright rosy-pink fragrant fl. May. Armenia. (Max Leichtlin.)

***Thalictrum rhyncocarpum.** Dill. et Rich. (*G. C.* 1892, v. xi., p. 722.) Ranunculaceæ. H. H. per. A most remarkable species, and one of the most elegant of the genus. Fl.-stems 3 ft. high, paniculate. L. like those of the maiden-hair fern. Fr. on long hair-like stalks. Summer. Transvaal. (Kew.)

***Thunbergia grandiflora,** Roxb. var. **alba,** Hort. (*G. C.* 1892, v. xii., p. 501.) Acanthaceæ. S. A pure white flowered variety. (Kew.)

Tillandsia massangeana, Hort. var. **superba,** Hort. (*Gard.* v. xli., p. 430.) Bromeliaceæ. S. "A fine plant of "vigorous growth, the foliage blotched "and barred transversely with a dark "bronzy shade upon a paler ground." (Probably a variety of *T. zebrina*. (J. Veitch & Sons.)

Tillandsia Moensii, Hort. (*Gard.* v. xli., p. 430.) S. "A species with "elegantly recurved foliage, veined or "mottled with pale green upon a "yellowish-green ground." (J. Veitch & Sons.)

Tobolewskya clavata. A misprint for **Sobolewskya clavata,** which see.

Tradescantia decora, Bull. (*Bull Cat.* 1892, p. 3.) Commelinaceæ. S. An ornamental foliage plant. L. elongate lanceolate, dark olive-green with a medium band of silvery-grey. Brazil. (W. Bull.)

Tradescantia Reginæ, Lind. and Rod (*Ill. H.* v. 39, p. 29, pl. 147; *G. C.* 1892, v. 11, p. 696, f. 102.) S. foliage plant with erect stems, bearing distichous lanceolate acuminate l. about 6 in. long, whitish-green, with the central part and margins transversely veined with dark green, and washed with purple along the midrib; the underside is purple. Peru. (L'Horticulture Internationale.)

Tradescantia superba, Lind. and Rod. (*Ill. H.* v. 39, p. 69, pl. 155.) S. foliage plant, with ovate-oblong acute l., dark green striped with whitish on each side of the midrib, purple beneath. Peru. (L'Horticulture Internationale.)

Trichodesma physaloides, DC. (*G. C.* 1892, xi., p. 363, fig. 51.) Boragineæ. G. A herbaceous perrenial with a fleshy rootstock, annual erect stems, glaucous green l., and pure white fl., with a purple calyx. South Africa. (Adlam.)

Trichopilia brevis, Rolfe. (*L.* v. 7, p. 91, pl. 332.) Orchideæ. G. A pretty species with long narrow bulbs, lanceolate acute l., and short racemes of 2–3 fl. Sep. and pet. narrow, dull yellow blotched with red-brown; lip with a short campanulate tube, white with a yellow stain in front. Peru. (L'Horticulture Internationale.)

***Tulipa billietiana,** Jord. and Four. (*B M.* t. 7253.) Liliaceæ. H. A fine showy tulip allied to *T. Didieri*, with lemon-yellow segments sometimes tinged with red. May. Upper Savoy. (Kew.)

Urceocharis Clibrani, M. T. Masters. (*G. C.* 1892, xii., p. 214, fig. 36.) Amaryllideæ. S. A garden hybrid between *Eucharis grandiflora* and *Urceolina pendula*. Fl. white. (Clibran & Son.)

Uropetalum becazzeanum, Damm. (*Gfl.* 1892, p. 611, f. 127.) Liliaceæ. S. bulb with tapering l., and lax racemes about 6 in. long, of drooping green fl. Abyssinia. (Dammann & Co.)

***Utricularia Humboldtii,** Schousb. (*Gard.* v. xli., p. 362; *G. and F.* v. v., p. 113.) Lentibularieæ. S. A semi-aquatic species with broad reniform l. on erect petioles 6 in. long, and scapes of pale lavender fl., larger than those of *U. montana*. British Guiana. (Baron Schröder.)

***Utricularia longifolia,** Gardn. (*Gard.* 1892, v. xli., p. 362.) S. A semi-aquatic species with strap-shaped l., and short erect scapes of mauve fl. (Probably the same as that called *U. rhytero-phylla*, see *Kew Bull.* 1890, App. II., p. 57.) British Guiana. (F. Sander & Co.)

Vanda arbuthnotiana, Kränzlin. (*G. C.* 1892, v. xi., p. 522.) Orchideæ. S. A new species near *V. Roxburghii.* It has bright green bilobed l. and golden-yellow fl. with purplish stripes. Malabar. (F. Sander & Co.)

Vanda teres, Lindl. var. **alba,** Hort. (*G. C.* 1892, v. xi., p. 664.) S. A variety with pure white fl. (Lord Rothschild.)

Vanda vitellina, Kränzlin. (*G. C.* 1892, v. xii., p. 206.) S. A new species resembling *V. cærulescens,* Griff., but the fl. are smaller and coloured egg-yellow. (Berlin Botanic Garden.)

***Vernonia podocoma,** Schultz. (*B.M.* t. 7255.) Compositæ. G. A tall-growing plant with large leathery foliage and a terminal panicle, which, on strong plants, is 3 ft. long, and nearly as much wide. The fl. are ½ in. long, tubular, and rose-purple, arranged in loose heads. S. Africa. (Kew.)

Veronica monticola, Traut. (*G. C.* 1892, v. xii., p. 614.) Scrophularineæ. H. A perennial trailing species with spreading tufts of oblong-lanceolate glabrous l., and spikes of small blue fl. Summer. Abschasia. (Correvon.)

***Viola declinata,** W. and K. (*G. C.* 1892, v. xi., p. 650; *Gard.* 1892, v. xli., p. 451.) Violarieæ. H. Height, ½ ft. Fl. large, deep bright purple, with darker markings near the yellow eye. L. ovate, bluntly toothed. May. Transylvania. (Kew.)

Vitis argyrophylla, Carr. (*R. H.* 1892, p. 222.) An error for **V. ægirophylla,** Boiss. Ampelideæ. H. Vine with very variable l., unequally and very sharply toothed. Turkestan. (Godefroy Lebeuf.)

Vriesea obliqua, Quintus. (*Gfl.* 1892, p. 201, t. 1369.) Bromeliaceæ. S. A garden hybrid, parents doubtful. (Quintus, Groningen.)

Vriesea tessellata, var. **sanderiana,** Hort. Sander. (*G. C.* 1892, v. xi., p. 731.) S. A variety with the l. more distinctly zoned and marbled than the type. (F. Sander & Co.)

Warscewiczella Lindeni, Hort. *See* **Zygopetalum Lindeni.**

***Yucca Hanburyi,** Baker. (*Kew Bull.* 1892, p. 8.) Liliaceæ. H. H. A new species, allied to *Y. angustifolia.* Acaulescent. L. in a dense rosette, linear, rigid green, with a pale brown edge and a few marginal filaments. Raceme simple, 1½ ft. long; fl. campanulate, 2 in. long, white. N. America. (T. Hanbury.)

Zelkova japonica, Dipp. var. **Verschaffelti,** Dipp. (*G. C.* 1892, v. xii., p. 669.) Urticaceæ. H. "In Belgian catalogues this elegant tree of small size appears as *Ulmus Verschaffelti,* and Dr. Dieck formerly announced it to be *Planera japonica.*" (Zöschen Arboretum.)

***Zygopetalum graminifolium,** Rolfe. (*G. C.* 1892, v. xi., p. 698, xii., 179; *L.* t. 340.) Orchideæ. G. This plant has been in cultivation several years, but it does not appear to have flowered till last year. It is a small-growing species with a slender creeping rhizome, small pseudobulbs, and narrow grassy l.; raceme erect bearing, from five to seven green and purple fl. (F. Sander & Co.)

Zygopetalum leucochilum, (*G. C.* 1892, v. xi., p. 214.) G. A garden hybrid between *Z. Burkei* and *Z. Mackayi.* (J. Veitch & Sons.)

Zygopetalum Lindeni, Rolfe. (*L.* v. 8, p. 5, pl. 337.) S. A beautiful species with lanceolate acute l., and solitary large white fl. veined with rose-purple on the very large lip. Syn. *Warscewiczella Lindeni,* Hort. (L'Horticulture Internationale.)

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX III.—1893.

LIST of the STAFFS of the ROYAL GARDENS, Kew, and of Botanical Departments and Establishments at Home, and in India and the Colonies, in Correspondence with Kew.

* Trained at Kew. † Recommended by Kew.

Royal Gardens, Kew :—

Director	W. T. Thiselton-Dyer, C.M.G., C.I.E., F.R.S., Ph.D., M.A., F.L.S.
Assistant-Director	Daniel Morris, C.M.G., M.A., F.L.S.
Assistant (Office)	*John Aikman.
,, ,,	*William Nicholls Winn.

Keeper of Herbarium and Library	John Gilbert Baker, F.R.S., F.L.S.
Principal Assistant (Phanerogams)	*William Botting Hemsley, F.R.S., A.L.S.
,, ,, (Cryptogams)	George Massee.
Assistant (Herbarium)	Nicholas Edward Brown, A.L.S.
,, ,,	*Robert Allen Rolfe, A.L.S.
,, ,,	Charles Henry Wright.
,, for India	Otto Stapf, Ph.D.
Attendant	John Frederick Jeffrey.

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Honorary Keeper, Jodrell Laboratory	Dukinfield Henry Scott, M.A., Ph.D., F.L.S.

Curator of Museums	John Reader Jackson, A.L.S.
Assistant (Museum)	John Masters Hillier.
Preparer	George Badderly.

Curator of the Gardens	George Nicholson, A.L.S.
Assistant Curator	William Watson.
Foremen :—	
Arboretum	*William J. Bean.
Herbaceous Department	*Walter Irving.
Greenhouse and Ornamental Department.	Frank Garrett.
Temperate House (Sub-tropical Department).	*Thomas Jones.

Cambridge.—University Botanic Garden :—

Professor	Charles C. Babington, F.R.S., F.L.S.
Deputy Professor	Francis Darwin, M.B., F.R.S., F.L.S.
Curator	*Richard Irwin Lynch, A.L.S.

Dublin.—Royal Botanic Gardens, Glasnevin :—

Keeper	Frederick W. Moore, A.L.S.

Trinity College Botanic Gardens :—

Professor	E. Perceval Wright, M.D., F.L.S., Sec. R.I.A.
Curator	*F. W. Burbidge, M.A., F.L.S.

Edinburgh.—Royal Botanic Gardens :—

Regius Keeper	Isaac Bayley Balfour, M.D., D.Sc., F.R.S., F.L.S.
Curator	Robert Lindsay.

Glasgow.—Botanic Gardens :—

University Professor	F. O. Bower, D.Sc., F.R.S., F.L.S.
Curator	*Daniel Dewar.

Oxford.—University Botanic Garden :—

Professor	Sydney H. Vines, D.Sc., F.R.S., F.L.S.
Curator	*William Baker.

COLONIES.

Antigua. (*See* Leeward Islands.)

Barbados.—Dodd's Reformatory, Botanical Station :—

	Superintendent	John R. Bovell, F.C.S.

British Guiana.—Botanical Gardens :—

Georgetown	Superintendent and Government Botanist	*George S. Jenman, F.L.S.
	Head Gardener	†John F. Waby.
	Second ,,	*Robert Ward.
	Promenade Garden :—	
	Head Gardener	William Jackson.
Berbice	Keeper	Richard Hunt.

British Honduras.—Botanical Station.

	Curator	†James McNair.

Canada.—

Ottawa	Dominion Botanist	Prof. John Macoun, M.A., F.R.S.C., F.L.S.
	Assistant ,,	Jas. M. Macoun.
	Director of Government Experimental Farms	Prof. Wm. Saunders, F.R.S.C., F.L.S.
	Botanist and Entomologist.	James Fletcher, F.L.S.
Montreal	Director, Botanic Garden.	Prof. Penhallow, B.Sc.

Cape Colony.—

	Government Botanist	Prof. MacOwan, F.L.S.
Gardens and Public Parks :—		
Cape Town	Curator	H. J. Chalwin.
Grahamstown	Curator	Edwin Tidmarsh.
Port Elizabeth (St. George's Park) :—		
	Superintendent	John T. Butters.
King Williamstown	Curator	*T. R. Sim.
Graaf Reinet	,,	J. C. Smith.
Uitenhage	,,	H. Fairey.

Ceylon.—Department of Royal Botanical Gardens :—

	Director	†Henry Trimen, M.B., F.R.S., F.L.S.
Peradeniya	Head Gardener	*Peter D. G. Clark.
	Clerk and Foreman	J. A. Ferdinandus.
	Draughtsman	W. de Alwis.
Hakgala	Superintendent	*William Nock.
	Clerk and Foreman	M. G. Perera.
Henaratgoda	Conductor	A. de Zoysa, Muhandiram.
Anurādhapura	,,	S. de Silva, Arachchi.
Badulla	,,	D. Guneratne.

Dominica. (*See* Leeward Islands.)

Fiji.—Botanical Station :—

	Curator	*Daniel Yeoward.

Gold Coast.—Botanical Station :—

	Curator	*William Crowther.
	Acting Curator	*Frederick E Willey.

Grenada.—Botanical Garden :—

	Curator	——

Hong Kong.—Botanical and Afforestation Department :—

	Superintendent	†Charles Ford, F.L.S.
	Assistant Superintendent.	*W. J. Tutcher.

Jamaica.—Department of Public Gardens and Plantations :—

	Director	†William Fawcett, B.Sc., F.L.S.
Hope Gardens	Superintendent	*William Cradwick.
Castleton Garden	,,	Eugene Campbell.
Cinchona (Hill Garden).	,,	*William Harris.
Kingston Parade Garden.	,,	Joseph Harris.
King's House Garden.	,,	*William J. Thompson.
Bath	,,	W. Groves.

Lagos.—Botanical Station :—

	Curator	*Henry Millen.
	Acting Curator	*Walter Haydon.

Leeward Islands.—Agricultural Department :—

	Superintendent	†Charles A. Barber, M.A. F.L.S.

Botanical Stations ;—

Antigua	Curator	*Arthur G. Tillson.
Dominica	,,	*Joseph Jones.
Montserrat	,,	Joseph Wade.
St. Kitts-Nevis	,,	——

Malta.—Botanical Garden :—

	Director	Dr. Francesco Debono.

Mauritius.—Department of Forests and Botanical Gardens :—

Pamplemousses	Director	*William Scott.
	Assistant Director of Gardens.	J. Vankeirsbilck.
	Assistant Director of Forests.	P. Randabel.
Curepipe	Overseer	William A. Kennedy.

Montserrat. (*See* Leeward Islands.)

Natal.—Botanical Gardens :—

Durban	Curator	John Medley Wood, A.L.S.
	Head Gardener	*James Wylie.
Pietermaritzburg	Curator	G. Mitchell.

New South Wales.—Botanical Gardens:—

Sydney	Director	Charles Moore, F.L.S.

New Zealand:—

Wellington.—Colonial Botanic Garden:—

	Director	Sir James Hector, K.C.M.G., F.R.S.
	Head Gardener	G. Gibb.
Dunedin	Superintendent	J. McBean.
Napier	„	W. Barton.
Invercargill	Head Gardener	Thomas Wangle.
Auckland	Ranger	William Goldie.
Christchurch	Head Gardener	*Ambrose Taylor.

Queensland.—Botanical Gardens:—

Brisbane	Curator	*Philip MacMahon.
	Overseer	J. Tobin.

Acclimatisation Society's Gardens:—

	Secretary and Manager	Wm. Soutter.
	Assistant „	A. Humphrey.
Rockhampton	Superintendent	J. S. Edgar.

St. Kitts-Nevis. (*See* Leeward Islands.)

St. Lucia.—Botanical Station:—

	Curator	†John Gray.

St. Vincent.—Botanical Station:—

	Curator	*Henry Powell.

South Australia.—Botanical Gardens:—

Adelaide	Director	Maurice Holtze, F.L.S.
Port Darwin	Curator	Nicholas Holtze.

Straits Settlements.—Gardens and Forest Department:—

Singapore	Director	†H. N. Ridley, M.A., F.L.S.
	Assistant Superintendent.	*Walter Fox.
Penang	Assistant Superintendent	†Charles Curtis, F.L.S.
Malacca	„	*Robert Derry.

Perak (Kuala Kangsar).—Government Plantations:—

	Superintendent	Oliver Marks.

Tasmania.—Botanical Gardens:—

Hobart Town	Superintendent	F. Abbott.

Trinidad.—Royal Botanical Gardens:—

	Superintendent	†John H. Hart, F.L.S.
	Assistant „	*Walter E. Broadway.

Victoria.—

Melbourne	Government Botanist	Sir F. Von Mueller, K.C.M.G.,F.R.S.,F.L.S.

Botanical Gardens:—

	Director	W. R. Guilfoyle, F.L.S.

INDIA.

Botanical Survey.—Director, George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.

Bengal, Assam, Burma; the Andamans and Nicobars; North-East Frontier Expeditions:—

Superintendent of the Royal Botanical Gardens, Calcutta - George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.

Bombay, including Sind:—

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Madras: the State of Hyderabad and the State of Mysore:—

Government Botanist and Director of Cinchona Plantations - †M. A. Lawson, M.A., F.L.S.

Western Provinces and Oudh; the Punjab; the Central Provinces; Central India; Rajputana; North-West Frontier Expeditions:—

Director of the Botanical Department Northern India, Saharanpur, N.W.P. †J. F. Duthie, B.A., F.L.S.

Bengal.—Department of Royal Botanic Gardens:—

Calcutta (Seebpore) - Superintendent - George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.
Curator of Herbarium Dr. David Prain, F.L.S., F.R.S.E.
" Garden - *Robert L. Proudlock.
Assistant " - ———

Mungpoo - Superintendent, Government Cinchona Plantations - - George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.
Deputy " - *J. A. Gammie.
1st Assistant - - *R. Pantling.
2nd " - - *Joseph Parkes.
3rd " - - G. A. Gammie.
4th " - - *Amos Hartless.

Darjeeling; Lloyd Botanic Garden:—
Curator - - *William A. Kennedy.

Darbhangah; Maharajah's Garden:—
Superintendent - Herbert Thorn.

Bombay.—

Poona - - ——— ———
Lecturer on Botany - *G. Marshall Woodrow.

Ghorpuri.—Botanical Garden:—
Superintendent - A. R. Lister.

Bombay.—Municipal Garden:—
Superintendent - ———

Central Provinces.—

Nagpur	Superintendent of Public Gardens.	*J. R. Ward.

Madras.—Botanical Department:—

Ootacumund	Government Botanist and Director of Government Gardens, Parks, and Cinchona Plantations	†M. A. Lawson, M.A., F.L.S.
	Curator of Gardens and Parks.	*Andrew Jamieson.

Madras.—Agri-Horticultural Society:—

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Mysore (Bangalore)	Superintendent	*J. Cameron, F.L.S.
	Curator	*J. Horne Stephen.
Baroda	Superintendent	*G. H. Krumbiegel.
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Travancore(Trivandrum)	„	*Frederick James Ingleby.
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Saharanpur and Branch Garden, Mussoorie.	„	William Gollan.

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Lahore	Superintendent	H. G. Hein.
Simla	„	*A. Parsons.